

EXAMINED.



State of Connecticut

REPORT

OF

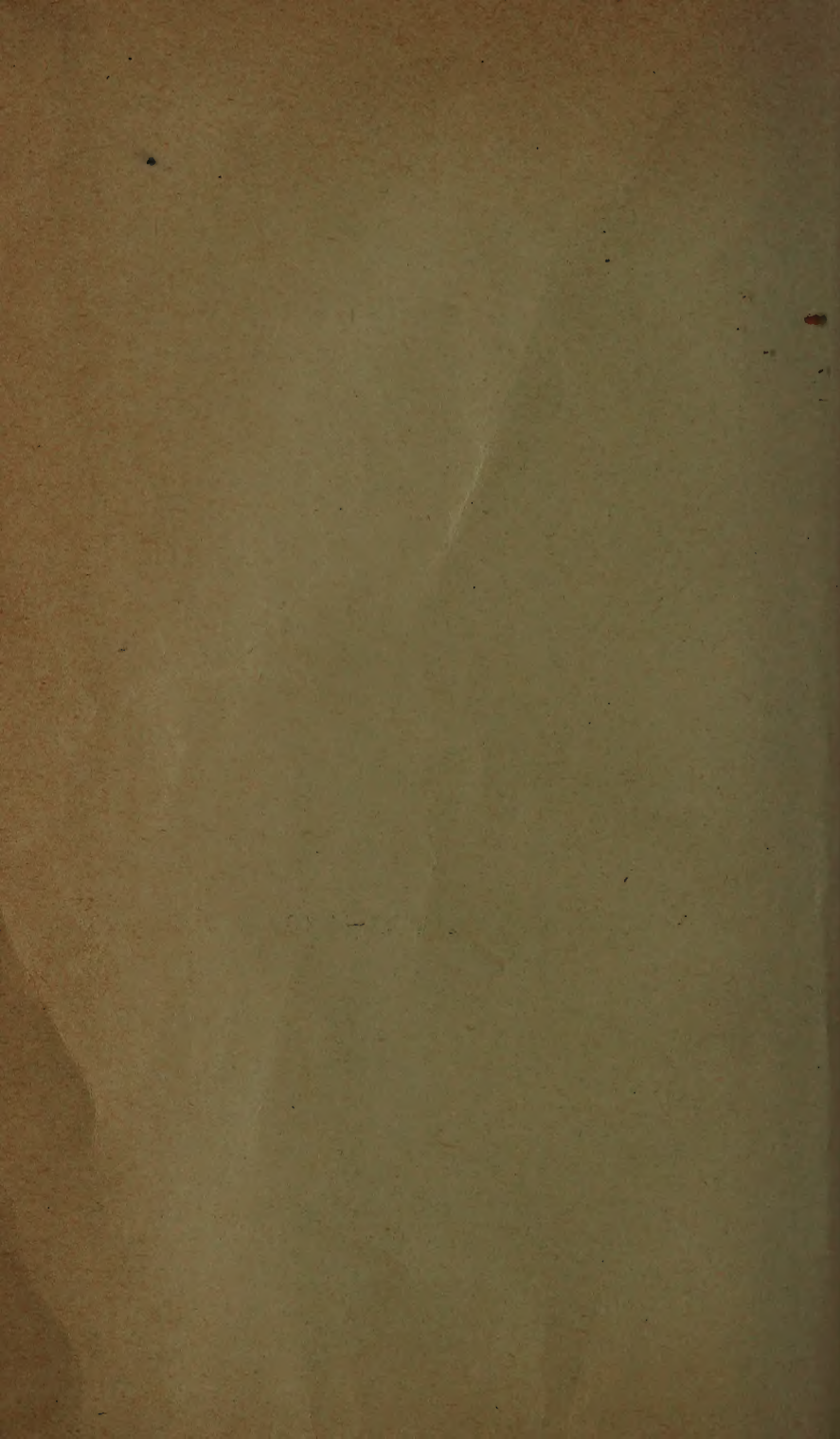
The Connecticut Agricultural
Experiment Station

NEW HAVEN, CONN.

THIRTEENTH REPORT OF THE STATE ENTOMOLOGIST, 1913

W. E. BRITTON, PH.D.

BEING PART III OF THE ANNUAL REPORT OF 1913



THIRTEENTH REPORT
OF THE
STATE ENTOMOLOGIST
OF
CONNECTICUT
FOR THE YEAR 1913

BY
W. E. BRITTON, Ph.D.
Station Entomologist

New Haven, Conn.

1914



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NOTE REGARDING AUTHORSHIP.

For bibliographical purposes, all articles and notes in this report should be credited to W. E. Britton, except where otherwise stated.

ILLUSTRATIONS.

Plates VIII, b, IX, b, and XI, a, are from photographs by W. E. Britton; all others by B. H. Walden.

The following illustrations have previously appeared in the publications of this Station.

Plate V, a, b, and c, and Plate VI, in Bull. 177, 1913.

Plate IX, a, in the Report for 1903.

PART III.

THIRTEENTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I have the honor to submit herewith my thirteenth report as State Entomologist of Connecticut. As it seemed advisable to issue all reports earlier than usual, this one covers only the fiscal year ending September 30th, 1913, except as regards nursery inspection; some of the examinations were made and the certificates issued later than that date, but it is convenient to have all the names in one list.

Respectfully submitted,

W. E. BRITTON,

State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM OCTOBER 1ST, 1912, TO SEPTEMBER 30TH, 1913.

Insect Pest Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	\$3,000.00
Account of 1912, balance	260.11
	\$3,260.11

EXPENDITURES.

For Field, office and laboratory assistance:

B. H. Walden, salary	\$1,120.00
H. B. Kirk, salary	75.00
Q. S. Lowry, salary	75.00
Frances M. Valentine, salary	520.00
Other Assistance	169.00
	\$1,959.00

Printing and illustrations	\$254.59	
Postage	99.30	
Stationery	33.29	
Telegraph and telephone	.85	
Express, freight and cartage	6.15	
Library	77.42	
Laboratory apparatus and supplies	82.92	
Office supplies	88.28	
Traveling expenses	228.22	
Balance, cash on hand	430.09	
		\$3,260.11

Gypsy Moth Control Account.

RECEIPTS.

Received from E. H. Jenkins, Treasurer	\$5,000.00
Account of 1912, balance	231.07
	\$5,231.07

EXPENDITURES.

For Salaries, board of scouts, etc.:

D. J. Caffrey, salary	\$ 637.50	
H. B. Kirk, salary	319.35	
Q. S. Lowry, salary	428.24	
Labor, board of scouts, etc.	2,285.37	
		\$3,670.46
Printing and illustrations	5.35	
Postage	11.51	
Tools and supplies	115.48	
Telegraph and telephone	9.50	
Express, freight and cartage	7.59	
Rental of storehouse	36.00	
Traveling expenses	774.85	
Balance, cash on hand	600.33	
		\$5,231.07

Memorandum:—This account of the State Entomologist has been duly audited by the State Auditors of Public Accounts

SUMMARY OF INSPECTION AND OFFICE WORK.

YEAR ENDING SEPT. 30, 1913.

- 468 samples of insects received for identification.
- 60 nurseries inspected.
- 60 regular certificates issued.
- 15 parcels inspected and certificated.
- 20 orchards and gardens examined.
- 1316 cases (259 shipments containing nearly 2,000,000 plants) imported nursery stock inspected.

- 189 apiaries containing 1,500 colonies, inspected. (84 apiaries containing 368 colonies, diseased with European Foul Brood.)
2499 letters written on official work.
259 reports to Federal Horticultural Board giving results of inspection of imported nursery stock.
768 bulletins mailed on request or to answer inquiries.
80 packages sent out by mail and express.
19 lectures and addresses made before granges, etc.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1913.

- Twelfth Report of the State Entomologist (Part III of Station Report for 1912): 88 pages, 2 text figures, 16 plates; 9,500 copies, distributed January 15, 1913.
Report of Committee on Injurious Insects: Proceedings Connecticut Pomological Society, 1912, p. 19, 4 pages.
The Mosquito Situation—Past, Present and Future: Report on Mosquito Control. Documents of the Civic Federation of New Haven, No. 10, p. 26, 12 pages, March, 1913.
Review of O'Kane's Injurious Insects: *Journal of Economic Entomology*, Vol. VI, p. 153, 1 page, February, 1913.
Mosquito Control Work in Connecticut in 1912: *Journal of Economic Entomology*, Vol. VI, p. 89, 3 pages, February, 1913.
Recent Studies on the Weevil and the Bud-Moth of the Walnut, and a Sawfly Attacking Blackberry: *Journal of Economic Entomology*, Vol. VI, p. 197, 2 pages, April, 1913.
Prevention of Mosquito Breeding.—Discussion of Paper: Proceedings American Society of Civil Engineers, Vol. XXXIX, No. 2, p. 290, 1 page, February, 1913.
Sanitation of Construction Camps.—Discussion of Paper: Proceedings American Society of Civil Engineers, Vol. XXXIX, No. 2, p. 296, 1 page, February, 1913.
The Apple-Tree Tent-Caterpillar: Bulletin 177, of this Station, 20 pages, 17 figures; 11,000 copies, August, 1913.
Connecticut Laws Relating to the Suppression of Insect Pests, Plant Diseases, and Contagious Diseases of Bees; special bulletin of this Station, 11 pages; 3,000 copies, August, 1913.
Two Walnut Insects: *Rural New Yorker*, 1 column, 2 figures, March 22, 1913.
Tent-Caterpillars and Web-Worms: *Tribune Farmer*, July 10, p. 17, 1913.
Report of Committee on Injurious Insects: *Connecticut Farmer*, February 15, 1913.
Rapid Spread of the Brown-Tail Moth: *Connecticut Farmer*, April 19, 1913.
Cabbage Maggot: *Connecticut Farmer*, May 24, 1913.
An Invasion of Tent-Caterpillars: *Connecticut Farmer*, May 24, 1913.
The Dying Hickory Trees: *Connecticut Farmer*, September 27, 1913.

Fakirs and Frauds in Tree Work: *Tree Talk*, Vol. I, No. 2, p. 6, November, 1913.

In Collaboration with Botanical Department.

Spray Calendar for Connecticut: Report of Connecticut Board of Agriculture for 1912, p. 23, 8 pages.

ENTOMOLOGICAL STAFF.

W. E. BRITTON, Ph.D.	<i>State and Station Entomologist.</i>
B. H. WALDEN, B.Agr.	<i>First Assistant.</i>
DONALD J. CAFFREY, B.S.*	<i>Assistant.</i>
HARRY B. KIRK†	<i>Assistant.</i>
QUINCY S. LOWRY, B.S.‡	<i>Assistant.</i>
IRVING W. DAVIS, B.S.§	<i>Assistant.</i>
MISS FRANCES M. VALENTINE	<i>Stenographer.</i>

Mr. Walden has continued as first assistant, and has charge of all work of the office in the absence of the Entomologist.

The work of the department was somewhat interrupted twice during the season. First, by the resignation, March 1st, of Mr. Harry B. Kirk, to accept a position in the Bureau of Entomology at Washington, D. C., Forest Insect Investigations, and second, the resignation of Mr. Donald J. Caffrey, May 15th, to accept a position in the Bureau of Entomology, Cereal and Forage Crop Investigations.

Mr. Kirk had been connected with this department for only about a year but had done some satisfactory work on the life history of the walnut weevil.

Mr. Caffrey had been in charge of the gypsy and brown-tail moth field work for more than three years, and it is largely due to his careful and systematic work that the former pest has been almost eradicated from the State and that the latter has been measurably checked. His resignation at the beginning of the caterpillar season left us short handed, without time to seek experienced help. Messrs Kirk and Caffrey both receive larger salaries in their new positions than they were paid here.

Mr. Quincy S. Lowry, B.S., a graduate of the Massachusetts Agricultural College, Amherst, Mass., Class of 1913, was appointed to succeed Mr. Kirk, and entered upon his duties

* Resigned May 15th, 1913. † Resigned March 1st, 1913. ‡ Beginning March 10th, succeeding Mr. Kirk. § Beginning August 25th, succeeding Mr. Caffrey.

March 10th, having then completed his college work. He helped inspect imported nursery stock, and in May, on the resignation of Mr. Caffrey, was sent to Wallingford to take charge of the gypsy moth field work there, as he had acquired considerable experience in Massachusetts.

Mr. Irving W. Davis, B.S., also a graduate of the Massachusetts Agricultural College, was engaged late in the summer as successor to Mr. Caffrey. Mr. Davis graduated in 1911, and during the following year taught in the Middlebury College, Middlebury, Vt. During the college year of 1912-1913 he was a graduate student at the Massachusetts Agricultural College. Mr. Davis has been assistant in entomology in Massachusetts and for three summers has served there as an inspector of apiaries. He commenced work in Connecticut August 25th, and will later take charge of the field work in controlling the gypsy and brown-tail moths.

Mr. L. B. Ripley of Glastonbury, a student of Trinity College, was employed during his summer vacation, June 17th to September 13th, in the laboratory and insectary.

Miss Frances M. Valentine has continued to do the stenographic and clerical work of the office. During her vacation, Miss Hazel White was employed as a substitute.

The apiary inspection work has been done, as in past years, by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, each receiving *per diem* wages and necessary traveling expenses.

All of the persons mentioned above have been faithful in their work and to them is due much credit for whatever success has been attained in the work of this department.

CHIEF LINES OF WORK.

The work of controlling the gypsy and brown-tail moths, and of inspecting growing and imported nursery stock, and of apiaries, has required much attention.

Mr. Walden has followed out the life history of a leaf roller on privet hedges, which proved to be *Archips rosana* Linn.

Experimental work against the onion thrips was conducted in the field of Mr. John S. Buck, Wethersfield.

Spraying tests to control the pea aphid were carried on in the field of Mr. Samuel Flight, Hamden.

Tests were made on the Station farm to control the cabbage maggot in early cabbages.

The effects of sprays on the control of apple insects in the Station orchard at Mt. Carmel, has been continued in coöperation with the botanical department of the Station.

Additional observations have been made on the walnut weevil, and the white pine weevil.

Several inspections were made to locate mosquito breeding places, and to ascertain if ditches were in satisfactory condition. The surface of West River, New Haven, was oiled under direction of this office to destroy a large brood of *Culex pipiens* larvæ in the water.

General studies are being made on insects attacking vegetable crops and those attacking peach and apple orchards in Connecticut.

Minor studies have been made on a vast number of different insects, mostly injurious, and many records of value have been obtained in field and insectary.

The department coöperated with other departments of the Station in an exhibit at Goshen Fair, September 1st and 2d; Washington, September 5th; and Granby, September 30th and October 1st.

Some time has been given to the insect papers to be published by the State Geological and Natural History Survey. That on Hymenoptera is now in press and the proof has been looked over and some indexing and other work done in this office.

The more important lines of work are described in detail in the following pages of this report.

INSPECTION OF NURSERIES.

The annual inspection of Connecticut nurseries, as required by law, was commenced August 26th. The progress of the work was interrupted by rainy weather, and by the Station exhibit at three fairs, which engaged the services of Mr. Lowry for nearly three weeks. In October the arrival of hundreds of cases of imported *Azaleas* requiring immediate inspection, also hindered the work of inspecting growing stock, which was finally finished November 3d. The inspections were made by Messrs. Walden, Lowry, Davis, Ripley and Britton, none of whom could work at it continuously.

Before commencing to inspect the nurseries the following letter was sent to each nurseryman:

NEW HAVEN, CONN., August 11, 1913.

Dear Sir: The annual inspection of Connecticut nurseries will be made during the next few weeks. If you are anxious for an immediate inspection, please notify this office and we will accommodate you if possible.

As several states have recently established new and efficient inspection systems and enacted new laws, and as several dangerous insect and fungous pests are in danger of becoming distributed, we plan to make the inspection more thorough this year than ever before. All woody stock will be examined including conifers.

Stock infested with some of the worst pests cannot be allowed to remain in the nursery without danger that other plants will become infested.

If important pests are found requiring destruction or immediate treatment of stock, directions to that effect will be given, and the nurserymen should remove or treat it promptly whereupon a certificate can be granted.

If any woody field-grown, nursery or florists' stock is imported by you in the future, from foreign countries, it will be illegal for you to unpack it before the inspector arrives, unless you have permission from this office to do so. (See Chapter 184, Public Acts of 1913.)

The object of the increased inspection and prompt treatment of the infested stock, is not to make trouble for the nurserymen, but to make more effective the inspection work and to prevent the spread of destructive pests.

Very truly yours,

W. E. BRITTON,

State Entomologist.

On the whole, the Connecticut nurseries were more nearly free of pests than ever before. The inspection was more thorough than usual. Conifers, privet, and other stock seldom attacked by pests were examined.

In the course of nursery inspection, though trees and plants are examined for all pests (especially new ones) those of the following alphabetical list particularly, were the objects of the examination:

INSECTS.

Aspidiotus forbesi Johns.

Cherry scale.

Aspidiotus ostryæformis Curt.

European fruit scale.

Aspidiotus perniciosus Comst.

San José scale.

Asterolecanium variolosum Ratz.

Pit-Making oak scale.

<i>Aulacaspis pentagona</i> Targ.	West Indian peach scale.
<i>Aulacaspis rosæ</i> Bouché	Rose scale.
<i>Chionaspis americana</i> Johns.	White elm scale.
<i>Chionaspis euonymi</i> Comst.	Euonymus scale.
<i>Chionaspis furfura</i> Fitch.	Scurfy scale.
<i>Chermes abietis</i> Linn.	Spruce gall louse.
<i>Cryptorhynchus lapathi</i> Linn.	Poplar and willow weevil.
<i>Euproctis chrysorrhæa</i> Linn.	Brown-Tail moth.
<i>Gossyparia spuria</i> Modeer.	Elm scale.
<i>Lecanium corni</i> Bouché	Apricot scale; New York Fruit Scale.
<i>Lepidosaphes ulmi</i> Linn.	Oyster-shell scale.
<i>Monarthropalpus flavus</i> Schr.	Boxwood leaf miner.
<i>Orthetria dispar</i> Linn.	Gypsy moth.
<i>Pulvinaria vitis</i> Linn.	Cottony maple scale.
<i>Sanninoidea exitiosa</i> Say.	Peach borer.
<i>Schizoneura lanigera</i> Hausm.	Woolly apple aphid.
<i>Scolytus rugulosus</i> Ratz.	Shot-hole borer; Fruit bark beetle.
<i>Toumeyella liriodendri</i> Gmel.	Tulip-tree scale.
<i>Zeuzera pyrina</i> Linn.	Leopard moth.

PLANT DISEASES.

<i>Bacillus amylovorus</i> Burr.	Fire blight.
<i>Bacterium tumefaciens</i> Smith & Townsend.	Crown-gall; Hairy root.
<i>Endothia gyrosa</i> var. <i>parasitica</i> Murr. (Clint.)	Chestnut blight or bark disease.
<i>Glæosporium venetum</i> Speg.	Raspberry anthracnose.
<i>Gymnosporangium Japonicum</i> Syd.	Japanese juniper rust.
<i>Gymnoconia interstitialis</i> (Schl.) Lagerh.	Blackberry orange rust.
Peach Yellows.	
<i>Peridermium</i> sps.	Pine blister rusts.
<i>Plowrightia morbosa</i> (Schw.) Sacc.	Black knot.

The inspectors were instructed to report all of these insects and plant diseases when found in nurseries, and to bring to the office samples of all insects found on nursery stock, which could not be readily recognized in the field. In like manner, they were instructed to watch for fungous and other diseases, and to bring in samples which were referred to Dr. G. P. Clinton, Botanist of this Station.

Wherever any of these serious troubles are found on nursery stock, the owner has been obliged to destroy certain trees and plants or parts of them, and give treatment to other stock. This

may consist of fumigating with hydrocyanic acid gas, spraying or dipping, according to the nature of the pest and the stock infested.

In each of several nurseries, a few chestnut trees were found diseased with the chestnut blight or bark disease, and these trees were ordered removed and burned.

In a number of instances persons who are not regular nurserymen desire to ship trees or shrubs to friends, or, perhaps, to plant elsewhere upon their own grounds. Such shipments are usually refused by transportation companies, unless accompanied by certificates of inspection. Fifteen such packages have been inspected during the year and a certificate issued for each.

The list of nurserymen for 1913 contains fifty-four names. Comparing it with last year's list, we find that one nursery has gone out of business, one has changed owners, and that five new ones have started. The total acreage devoted to the growing of nursery stock as given in the report of this Station for 1912, page 219, as 1082, has not changed materially though probably there has been a slight increase.

The list for 1913 follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1913.

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Barnes Brothers Nursery Co.....	Yalesville	Oct. 14,	545
Beattie, Wm. H.....	New Haven.....	Oct. 30,	565
Bowditch, J. H.	Pomfret Center ...	Sept. 15,	528
Brainard Floral and Nursery Co..	Thompsonville....	Sept. 15,	527
Bradley, H. M.....	Derby.....	Oct. 14,	546
Braley & Co., S. A.....	Burnside	Sept. 11,	523
Bretschneider, A.....	Danielson	Nov. 17,	572
Brooks Bros.	Westbrook	Nov. 19,	574
Burroughs, Thos. E.....	Deep River.....	Sept. 17,	532
Burr & Co., C. R.....	Manchester	Sept. 17,	530
Chapman, C. E.....	North Stonington..	Oct. 27,	556
Comstock & Lyon.....	Norwalk.....	Oct. 28,	559
Conine Nursery Co., F. E.....	Stratford.....	Sept. 29,	539
Conn. Agricultural College (Prof. A. G. Gulley).....	Storrs	Nov. 18,	573
Conn. Agr. Experiment Station (W. O. Filley, State Forester)...	New Haven.....	Oct. 28,	561
Conway, W. B.....	New Haven.....	Sept. 6,	521
Cross Highway Nurseries.....	Westport.....	Oct. 21,	551

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Dehn & Bertolf.....	Greenwich.....	Oct. 22,	552
East Rock Park Nursery (G. X. Amrhyh, Supt.).....	New Haven.....	Sept. 24,	536
Elm City Nursery Co.....	New Haven.....	Sept. 26,	538
Gardner's Nurseries.....	Cromwell.....	Oct. 30,	564
Hartford Park Commissioners (G. A. Parker, Supt.).....	Hartford.....	Sept. 17,	533
Hartridge, S.....	Norwich.....	Oct. 18,	548
Heath & Co., H. S.....	Manchester.....	Sept. 17,	531
Hilliard, H. J.....	Sound View.....	Nov. 13,	571
Holcomb, Irving.....	Granby.....	Oct. 16,	547
Houston & Sons, J. R.....	Mansfield Depot..	Oct. 27,	557
Hoyt's Sons Co., Stephen.....	New Canaan.....	Oct. 7,	542
Hubbard & Co., Paul M.....	Bristol.....	Oct. 28,	560
Hunt & Co., W. W.....	Hartford.....	Sept. 17,	534
Kellner, H. H.....	Danbury.....	Oct. 23,	553
Kelsey & Sons, David.....	West Hartford...	Nov. 4,	568
Long, J. A.	East Haven.....	Nov. 6,	569
Mount Carmel Forestry and Nursery Co. (C. A. Metzger, Mngr.)	Hartford.....	Oct. 27,	558
Munro, Chas.....	New Haven.....	Oct. 7,	543
New Haven Nurseries Co.....	New Haven.....	Sept. 15,	526
Northeastern Forestry Co.....	Cheshire.....	Oct. 11,	544
Phelps, J. Wesson.....	Bolton.....	Oct. 30,	563
Pierson, A. N.	Cromwell.....	Oct. 21,	550
Platt Co., The Frank S.....	New Haven.....	Sept. 24,	537
Purinton, C. O.....	Hartford.....	Sept. 15,	529
Reck, Julius.....	Bridgeport.....	Oct. 18,	549
Schleichert, F. C.....	Bridgeport.....	Nov. 12,	570
Scott, J. W.....	Hartford.....	Sept. 18,	535
Seavey, Wallace.....	New Haven.....	Oct. 7,	541
Sierman, C. H.....	Hartford.....	Sept. 12,	524
South Wilton Nurseries.....	South Wilton.....	Oct. 23,	554
Stanhope, B. P.	Niantic.....	Oct. 31,	566
Streckfus, H. P.....	Litchfield.....	Sept. 6,	522
Turner & Co., Chas.....	Hartford.....	Sept. 13,	525
Vidbourne & Co., J.....	Hartford.....	Oct. 6,	540
Windsor Nurseries, W. B. Bryant, Prop.....	Windsor.....	Oct. 24,	555
Woodruff, C. V.....	Orange.....	Oct. 29,	562
Young, Mrs. Nellie A.....	Pine Orchard.....	Nov. 4,	567

INSPECTION OF IMPORTED NURSERY STOCK.

By W. E. BRITTON AND B. H. WALDEN.

In the report of this Station for 1912, page 223, it was announced that a Federal quarantine and inspection law had been enacted to become operative October 1, 1912. This law provides for a system of notices and permits covering all imported field-grown woody stock entering the United States from other countries, and its enforcement is vested in a board designated as the Federal Horticultural Board. (See Circular 41, Office of Secretary of Agriculture.)

The regulations of the Federal Horticultural Board require that the importer, who is usually the broker, shall send a notice of each shipment to the state nursery inspector of the state to which the shipment is consigned. The Federal Horticultural Board issues a permit before the stock can enter the United States, and this Board also sends to each state inspector a notice in duplicate of each shipment consigned to that state. Both copies are to be filled out after the stock has been inspected; one is returned to the Federal Horticultural Board and the other kept on file as a record in the state inspector's office.

Though in Connecticut for the past four years we have inspected the imported stock received at the regular nurseries, only a portion of the stock imported by florists and private estates has been examined. In fact, in many cases we did not know about the importations. After the Federal Law became operative October 1, 1912, however, we received notices, the same as for all other stock, and we requested that the consignee send notice to this office immediately on the arrival of each shipment so that we might inspect it. Return post cards were furnished. In some cases the consignee complied with the request, but in many instances the stock was unpacked and distributed without sending such notice. In other cases notice was sent, and the inspector found that the stock had been unpacked and mixed with other stock, or perhaps some of it shipped away, so that it was impossible to give it a proper inspection. It seemed futile to attempt to inspect this stock at all unless the inspection could be thoroughly and properly done. The matter was, therefore, placed before the legislature and

Section 4388 of the General Statutes, was amended to read as follows:

Sec. 4388. *Certificate of Inspection of nursery stock. Penalty. All nursery stock shipped into this state shall bear on each package a certificate that the contents of said package have been inspected by a state or government officer and that said contents appear free from all dangerous insects and diseases. If nursery stock is brought into the state without such a certificate, the express, freight, or other transportation company or person shall, before delivering shipment to consignee, notify the state entomologist of the facts, giving name and address of consignee, origin of shipment, and approximate number of cars, boxes, or packages, and probable date of delivery to the consignee. The state entomologist may cause the inspection and if infested the treatment of the stock. No person, firm, or corporation shall unpack any woody field-grown nursery or florists' stock brought into this state from foreign countries except in the presence of an inspector, unless given permission to do so by said state entomologist or one of his deputies. If such stock is found infested with any dangerous pests the state entomologist may at his discretion order it treated. Any person violating any of the provisions of this act shall be fined not more than fifty dollars. (Amendment approved June 5, 1913.)

After the passage of the new law, and before the arrival of many shipments of imported stock, the following letter was sent to all florists and others, of which there were records in this office, as having received importations of stock from foreign countries.

NEW HAVEN, CONN., August 23, 1913.

To Connecticut Importers of Nursery Stock:

GENTLEMEN:—Your name is among those who, during the past two or three years, have imported into Connecticut, nursery stock from foreign countries.

I wish to call your attention to the recent change in the General Statutes of Connecticut, Section 4388, a copy of which is enclosed. You will see that hereafter it will be illegal to unpack such shipments of nursery stock except in the presence of an inspector, unless permission is obtained from this office.

In the future when stock from foreign countries arrives at your place, please send notice promptly to this office, and an inspection will be made at the earliest possible moment. If for any reason you desire to unpack the stock before the inspector arrives, you should telephone to this office for permission to do so.

* See Chapter 184, Public Acts of 1913.

The object of inspecting such stock is to prevent the establishment in the United States of pests now existing in other countries.

Very truly yours,

W. E. BRITTON,

State Entomologist.

During the year just closed, 1316 boxes and packages of imported nursery stock has been inspected by this department. This stock was contained in 246 separate shipments. Of thirteen other shipments reported, four were reshipped to other states, two were greenhouse grown, four contained herbaceous stock, and three were not received by the consignee. These of course were not inspected. The stock came from the following sources.

IMPORTED NURSERY STOCK.

INSPECTED DURING THE YEAR ENDING SEPTEMBER 30, 1913.

Country.	No. Shipments.	No. Cases.
Holland	103	681
Belgium	57	377
France	26	117
England	21	62
Germany	11	15
Scotland	8	11
Ireland	5	30
Hungary	1	1
Japan	3	8
Italy	1	1
Source not traced	10	13
Total	246	1316

In the inspection of this imported nursery stock, in 1913 insects and plant diseases were found in seven shipments as follows:

On March 22, 1913, a species of *Lachnus* was found on conifers from the nursery of F. Delauney, Angers, France.

A single specimen of the Chrysomelid beetle, *Agelastica* (*Galeruca*) *alni* Linn., was found April 4 by Mr. Lowry on the outside of a box of general ornamental stock from the nursery of H. den Ouden and Son, Boskoop, Holland. The same species was previously found in a shipment of English ivy, *Hedera helix* from Holland, and was noted in the report of this Station for 1912, page 292.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., on lilac, and an aphid (undetermined) on maple, was found April 7 in a shipment of stock from Alma Nurseries, Oudenbosch, Holland.

An egg mass of the Chinese mantid, *Tenodera sinensis* Sauss., was found April 26 on umbrella pine from the Yokohama Nursery Co., Yokohama, Japan.

On April 28, two specimens of mealy bug (not identified) were found on conifers from the nursery of Arthur De Meyer, Ghent, Belgium.

On May 16, specimens of a soft scale, *Coccus hesperidum* Linn., and of the circular or fig scale, *Chrysomphalus aonidum* Linn., were taken from bay trees (*Laurus nobilis*) from Soci  t   Anonyme Horticole de Mont St. Amand, Ghent, Belgium.

On May 27, a single noctuid pupa was found in a nest in the top of a plant of box (*Buxus*) from the nursery of Kluis and Koning, Boskoop, Holland. The nest may have been an old bird's nest or a mouse nest. The adult moth emerged shortly and was identified by Dr. H. G. Dyar as *Mamestra dissimilis* K.

Late in the fall on a number of shipments of *Azaleas*, mostly from Belgium, there was found an *Aleyrodes* which Professor A. L. Quaintance considers an undescribed species.

On March 28, the Juniper rust, *Gymnosporangium clavari  forme*, Jacq., was found on 78 three-year seedlings of *Juniperus communis* var. *hybernica* from the nursery of James Fil, Ussy, France. This rust was determined by Dr. G. P. Clinton, botanist of this Station.

Late in the fall a number of shipments of *Azaleas*, mostly from Belgium nurseries, contained small galls on the new shoots and leaves, and occasionally on the hardened wood. These galls were considered to be caused by a fungus *Exobasidium*, by Mrs. Flora Patterson of Washington, D. C., but as the fungus was not in fruit, it could not be specifically determined.

The actual work of inspecting this imported stock has been mostly done by the assistants. In order to inspect stock at distant points it is often necessary to take early trains and return to New Haven late in the evening. Many days the inspector is thus obliged to work twelve or more hours. A record was kept of the time required to inspect each shipment including that of traveling both ways; this is equivalent to one man working

151 days of eight hours each, or more than six months of the year. At the salaries usually paid assistants, the services of the inspector for this time, together with the necessary traveling expenses, amounts to more than one thousand dollars. By recent legislative provision the expense of this work may now be charged wholly to the gypsy and brown-tail moth account.

INSPECTION OF APIARIES.

At the Autumn meeting of the Connecticut Beekeepers' Association, held in Middletown in 1912, it was voted to ask for a larger appropriation for inspecting apiaries and to amend the law to make the work more effective. A legislative committee was appointed to attend to the matter, the following points to be included:

1. Authority to inspect without complaint.
2. Authority to quarantine diseased apiaries.
3. Requiring that a certificate of good health accompany each shipment of bees whether brought into the state from without or moved from one point to another within the state.
4. A larger appropriation.

After due consideration and several conferences, in which the State Entomologist was present, a bill was introduced into the General Assembly which was intended to replace the law on the statute books. This bill asked for an appropriation of \$1,500.00 annually for inspection of apiaries. Hearings were held before the Committees on Agriculture and on Appropriations; certain changes were made by the Clerk of Bills in the wording of certain sections, and the appropriation was cut to \$750.00 per year. The act as finally passed is as follows:

AN ACT CONCERNING THE SUPPRESSION OF CONTAGIOUS DISEASES AMONG BEES.

Chapter 141 of Public Acts of 1913.

SECTION 1. *Duty of state entomologist.* It shall be the duty of the state entomologist, to such extent as he shall deem necessary or expedient, to examine apiaries and to quarantine such as are diseased, and to treat or destroy cases of the disease known as foul brood.

SEC. 2. *Authority to inspect.* The state entomologist may appoint such deputies or inspectors as he may deem necessary or expedient, and said state entomologist, or any person whom he may appoint for that purpose, shall have access at reasonable times to any apiary or place where bees are kept or where honeycomb and appliances are stored.

SEC. 3. *Regulations and records.* The state entomologist is hereby authorized to make suitable regulations regarding inspections and quarantine and to prescribe suitable forms for permanent records which shall be on file and open to public inspection, and to make reasonable rules for the services of said deputies or inspectors, and may pay a reasonable sum for such services.

SEC. 4. *Quarantine.* No person or corporation shall remove bees under quarantine to another locality without obtaining the written permission of a duly authorized inspector. No person or transportation company shall receive for transportation any colony or package of bees, unless said colony or package is accompanied by a certificate of good health, furnished by a duly authorized inspector. No person or transportation company shall deliver any colony or package of bees brought from any other country, province, state, or territory unless accompanied by a certificate of health furnished by a duly authorized inspector of such country, province, state, or territory. Any person or transportation company receiving a shipment of bees from without the state, unaccompanied by such certificate, shall before delivering such shipment to its consignee, notify the state entomologist and hold such shipment until inspected by a duly authorized inspector. In case contagious diseases are found therein such shipment shall be returned to the consignor or delivered to a duly authorized inspector of this state for treatment or destruction, provided the requirements of this section shall not apply to shipments of brood comb, with or without bees, suspected of being diseased and consigned to the state entomologist, the agricultural experiment station, or any duly authorized apiary inspector of the state, or to the bureau of entomology of the United States or the United States department of agriculture, providing there shall be no destruction of any shipment of bees as herein provided in the absence of reasonable notice to the consignee thereof.

SEC. 5. *Hindrance illegal.* No person shall resist or hinder the state entomologist, or any deputy or inspector whom he may appoint, in the performance of the duties imposed by this act.

SEC. 6. *Penalty.* Any person violating any of the provisions of this act shall be fined not more than fifty dollars.

SEC. 7. *Appropriation.* The necessary expenses incurred under the provisions of this act to an amount not exceeding seven hundred and fifty dollars annually, shall be paid by the comptroller on duly accredited vouchers.

SEC. 8. Chapter 185 of the public acts of 1909 is hereby repealed.

Approved June 6, 1913.

As the appropriation provided in Section 7, did not become available until after October 1st, 1913, it is too late to use it in any inspection work before next season. The \$300.00 remaining unexpended, under the old law, was available, and the work of inspecting apiaries in 1913 was continued as in previous years, Mr. H. W. Coley of Westport acting as inspector for the four southern counties of the state and Mr. A. W. Yates for the four northern counties.

As in 1912, an effort was made to examine apiaries in sections of the state not previously covered by the inspectors. Considerable European foul brood was found in Chatham, Coventry, Danbury, Norwich, Putnam, Pomfret, Thomaston, and Winchester. Some infested colonies were found in Andover, Barkhamsted, Beacon Falls, Bloomfield, Bolton, Burlington, Canton, Darien, Derby, Fairfield, Farmington, Litchfield, Manchester, Marlboro, Meriden, Montville, Norwalk, Stamford, Stratford, Waterbury, Wethersfield, West Hartford, Weston, Westport and Wilton. Most of the apiaries examined had not been inspected the previous season.

The statistics of apiary inspection in 1913 are shown in the following table:

APIARIES INSPECTED, 1913.

	Apiaries	Colonies
Number inspected	189	1,500
Infested, European foul brood	84	368
Per cent. infested	44.4	24.5
Other troubles:		
Sacbrood		42
Average number of colonies per apiary		7.9
Cost of inspection, paid by state		\$299.90
Cost of inspection, paid by Station		8.60
Total cost of inspection		\$308.50
Average cost per apiary	\$1.63	
Average cost per colony	.21	

For the purpose of comparison a summary of the inspections for the past four years, since the work was instituted, is given in the following table:

SUMMARY OF APIARY INSPECTION IN CONNECTICUT.

	1910	1911	1912	1913
Number apiaries inspected	208	162	153	189
Number infested Europ. foul brood ...	158	84	73	84
Per cent. infested Europ. foul brood ..	75.9	51.8	47.7	44.4
Number colonies inspected	1,595	1,571	1,431	1,500
Number infested Europ. foul brood ...	793	431	337	368
Per cent. infested Europ. foul brood ..	49.7	27.4	23.5	24.5
Average number of colonies per apiary	7.6	9.7	9.3	7.9
Total cost of inspection	\$499.85	\$323.08	\$299.80	\$308.50
Average cost per apiary	2.40	1.99	1.96	1.63
Average cost per colony	.28	.21	.21	.21

With the increased appropriation available for next season, and with authority to inspect without complaint, it will be possible to inspect a much larger number of apiaries than ever before. The cost per apiary and also per colony, should be slightly reduced.

On account of the importance and necessary part which insects play in the pollination of cultivated plants, the apiary interests of Connecticut are far more important than the statistics of valuation would seem to show.

GYPSY MOTH CONTROL WORK.

This insect has been all but exterminated in the only two areas known to be infested in Connecticut, Wallingford and Stonington. The field work for the past three years has been in charge of Mr. Donald J. Caffrey, who resigned May 15th, at the beginning of the caterpillar season, to accept a position in the Bureau of Entomology at Washington. No caterpillars or egg-masses have been found in Stonington since the spring of 1911 when three egg-masses were destroyed, and the pest was thought to be exterminated in this locality. The finding of a few caterpillars, therefore, last summer, places the matter in a different light.

In the summer of 1912 only twenty-six caterpillars and one pupa were found at Wallingford, an account of which appears in the latest report of this Station (see report for 1912, pp. 224-226).

The scouting for egg-masses began on November 21, 1912, and was conducted by two Federal scouts and Messrs. Donald J. Caffrey and H. B. Kirk of the staff of this department.

SCOUTING FOR EGG-MASSSES.*

Wallingford.

As the result of this scouting two egg-masses were discovered, one on the brick foundation of the house at No. 53 South Orchard Street, and another on the fence in the rear of No. 45 South Orchard Street, a few paces further north. A careful and systematic search of the square, where caterpillars had been taken the previous summer, failed to reveal any egg-masses; this square being examined twice, once by the State scouts and again by the Federal scouts.

The area between Main Street, and the railroad tracks was finished at Christmas. The work was then transferred to Stonington until January 6th, when operations at Wallingford were again resumed. The time from this date until January 20th, was occupied in scouting the outlying regions as far as the Masonic Home on the west, Soldier's monument and borough limits on the north, East Wallingford railroad station on the east, and the railroad bridge on the south.

Stonington.

Although caterpillars or egg-masses have not been found in Stonington for the past two years, it was deemed advisable to examine the area formerly infested, to guard against any possible outbreak that may occur. Accordingly the writer, accompanied by two Federal scouts, went to Stonington on December 26th, 1912, and remained until January 4th, 1913. During this time the trees, bushes, etc., were examined all through the borough itself and as far east as the velvet mill and Chapman's, on the north to the open space above Darrel's, and on the west to Walnut Grove. Particular attention was given the locality around Stanton's and Koelb's, where the caterpillars were last found. No egg-masses of the gypsy moth were discovered in this area.

SCOUTING IN OTHER PARTS OF THE STATE.

Scouting for gypsy moth egg-masses in other parts of the state was started on April 17th, and continued until May 10th. F. W. Carter and W. A. Collins, two Federal scouts, were detailed for this work and were assisted for part of the time by the writer (Mr. Caffrey).

* Written by D. J. Caffrey.

New London.

About two weeks were devoted to the vicinity of New London on both sides of the river. The danger of the gypsy moth being introduced into this section may be considered great, as the annual Harvard-Yale boat races in June, on the Thames River, attract many people who come in automobiles from the badly infested districts in Massachusetts and Rhode Island. This occurs at a time when the caterpillars are most active with the consequent danger of introducing the species.

On the west side of the river the city of New London was scouted on the south to Ocean Beach and along the main road north through Quaker Hill, Montville and Uncasville to Thamesville.

On the east side of the river Groton was scouted on the south to Avery Point and along the main road north through Gales Ferry to Norwich, including the section around Laurel Hill. In addition the trees around the railroad yards at Midway were examined and along the road leading east from Poquonoc Bridge.

No traces of the gypsy moth were found at the above named places.

Thompson.

One week was devoted to scouting in the town of Thompson. The gypsy moth has been found in the adjoining towns a few miles from the line in both Massachusetts and Rhode Island, and may be expected at some time to establish itself in Thompson, or neighboring towns, because of the natural spread of the insect. The villages of the town were scouted and most of the territory in the northern and eastern parts of the town. No egg-masses were found.

In this work, only the apple and white oak trees were examined with those along the streets and highways, as it has been repeatedly noted that when the insect is first discovered in any locality, the egg-masses are invariably on apple, white oak or street trees.

From the foregoing notes by Mr. Caffrey, it will be seen that in all of this work, by the Federal scouts and the scouts of this department, only two gypsy moth egg-masses were found—and those in Wallingford.

DESTROYING CATERPILLARS.

Wallingford.

On the resignation of Mr. Caffrey, in May, Mr. Quincy S. Lowry, who had gained experience in gypsy moth work in his native town in Massachusetts, was placed in charge of the field work at Wallingford. Messrs. Walden, Caffrey, Lowry and Britton visited Wallingford on May 12th, and looked over the situation. Small rose bushes, growing close to the spot where one egg-mass was creosoted during the winter at No. 53 South Orchard Street, were examined and two caterpillars found. On May 20th, Mr. Lowry found another caterpillar near this place on a rose bush. These three were the only caterpillars taken in Wallingford in the summer of 1913.

The trees were banded as usual, beginning May 19th and finishing a few days later. The section banded included the area between the railroad tracks on the west to Church Street, on the north to North Main Street, to Center Street, then east to Fair Street, and south to Ward Street, and 2,135 bands were applied. Tanglefoot bands were also used on all the trees in the cemetery and in several other places which had previously been considered as danger spots.

The burlap bands were turned about every other day. Messrs. C. W. Bolton, R. A. Emmons and George H. Hassett were employed to do this work. Mr. Lowry spent much of his time in scouting inside and outside of the banded territory. Many trees were climbed and searched for caterpillars, but none were found. The bands were removed August 9th and the men discharged.

Messrs. McIntyre and Foster, Federal employees who scouted around Stonington, worked at Wallingford during the week of August 11th-16th, examining the territory outside of the banded area. No gypsy moths were found. The work will be continued under the supervision of Mr. Davis and kept up until it is reasonably certain that the pest has been wholly eradicated from this locality.

RECORD OF GYPSY MOTHS DESTROYED AT WALLINGFORD.

Year	Egg-Masses	Caterpillars	Cocoons
1910	8,234	8,936	96
1911	23	1,551	15
1912	5	26	1
1913	2	3	0

Stonington.

Mr. Fred Hoadley, who has been employed for several seasons, had charge of the field work during the summer of 1913. He began banding trees May 19th, and finished before June 1st. At first no others were employed, but on June 27th Mr. Hoadley found a caterpillar on one of the apple trees north of the Stanton House. This discovery was reported promptly to this office by telephone, and I visited the place that afternoon. There are thirteen trees of rather large size in this group, which adjoins Darrel's, and which is perhaps four hundred feet from the Main Street highway with tall grass between. Mr. Hoadley was then instructed to extend the banded area, to hire more men to prune trees and to turn burlap bands, and to personally scout for caterpillars in addition to superintending the work of the other men. The first week in July a caterpillar was found in the yard of the late Dr. C. E. Brayton, on Elm Street, and another in the yard of Clark Lillibridge, corner of Trumbull and North Main streets. Two weeks later, a caterpillar was found in the apple orchard back of the old Stanton House, several hundred feet south of where the first one was discovered in June. A chrysalis or cocoon, was found July 25th in Mr. Sylvia's yard, corner of Oak and North Main streets. On the same day a caterpillar was found on an apple tree near North Main Street, in the rear of Mrs. Babcock's house on Broad Street. On August 13th, Mr. Hoadley found a female moth depositing eggs on an apple tree in the rear of the old house on the Stanton place. The moth was killed and the egg-mass creosoted.

Thus altogether five caterpillars, one cocoon or chrysalis and one female moth, or a total of seven gypsy moths were found in Stonington, where no caterpillars had been found since 1910 and no egg-masses since 1911, though the trees have been banded each year. The presence of the caterpillars is not yet understood, unless it be a reinfestation. The pest could hardly have remained in Stonington all of this time, without there being more caterpillars in 1913, and without escaping notice. The few that were found were rather widely scattered, some being perhaps nearly one-fourth of a mile apart.

Scouting was widespread and thorough. In addition to that done by Mr. Hoadley, Mr. L. B. Ripley was sent to Stonington

where he worked during the week ending July 26th. He examined much territory both in and outside of the banded area but found nothing.

Messrs. McIntyre and Foster, trained scouts, were sent to Stonington by Mr. A. F. Burgess of Boston, Mass., who now has charge of the Federal work against the gypsy and brown-tail moths. These men worked there from July 28th to August 9th, and spent most of their time examining the territory outside of the banded area, especially within the town of Stonington, north, east and west of the borough, with a view of discovering infestations from which the caterpillars might have been carried into Stonington or blown there by the winds. The young caterpillars are now known to blow several miles, especially from high elevations.

Messrs. McIntyre and Foster scouted the road to Westerly, Elihu's Island, the road to Mystic, and the roads between Stonington and Old Mystic. They also visited Mason's Island and Fisher's Island. They found no other infestation in Connecticut, but did find a single chrysalis or cocoon near the end of the trolley line in Westerly, R. I. As Mr. McIntyre, with a gang of men, scouted all around Westerly in the spring of 1912 and found nothing, it did not seem possible that any large infestation could have developed there.

The men employed by Mr. Hoadley in Stonington were Paul McDermott, Henry McGowan, Edward Higgins, Henry C. Sylvia, Herman Simon and John Flynn. Altogether about 2,800 burlap bands were applied and tanglefoot was used on a number of trees. The burlap was all removed and the work closed for the season on September 2d.

All old apple trees within the infested area were scraped, pruned, and cavities filled a few years ago, when Mr. G. H. Hollister was in charge of the work. Much brush was cut and the territory generally cleaned up. Though it has not received particular attention since, and more of this work still remains to be done, the trees generally are in much better condition than when Mr. Hollister started there.

Mr. Davis now takes charge, and will make every possible effort to again exterminate the pest in this locality. The trees will be pruned and put into condition for our work, and the

banded area which has been reduced since 1911, because no caterpillars were found, must again be extended.

RECORD OF GYPSY MOTHS DESTROYED IN STONINGTON,

Year	Egg-Masses	Caterpillars	Cocoons
1906	73	10,000	47
1907	118	2,936	200 .
1908	73	2,560	44
1909	6	98	0
1910	1	146	1
1911	3	0	0
1912	0	0	0
1913	0	5	1

CONTROLLING THE BROWN-TAIL MOTH IN 1913.

By W. E. BRITTON AND DONALD J. CAFFEY.

An account of previous work against this insect may be found in the reports of this Station for 1910, pp. 683 to 689; 1911, pp. 281 to 286; 1912, pp. 229 to 236.

The control measures against the brown-tail moth were continued in 1913 along the same lines as in former years. During the past winter three gangs of men were employed in scouting Windham County, Tolland County, the eastern half of Hartford County, and all of New London County, except the southwestern corner, in order to destroy the nests of the insect when found and to determine the limits of infestation. Nests were found and destroyed in that portion of the State lying east of Suffield and West Hartford, and north of West Hartford, Willimantic and Jewett City, with scattering infestations in Norwich and Stonington.

The worst infested area comprises Thompson, Woodstock, Putnam and Pomfret. At Hartford and Suffield small badly infested areas were found, with scattering nests in the vicinity. In the other towns found to be infested the nests were few in number and widely distributed.

The territory to be scouted was divided between the gangs employed for that purpose. One gang in charge of Mr. J. H. Osgood, commencing December 26th, worked the towns in the northeastern corner, another gang in charge of Mr. H. B. Kirk, beginning January 31st, worked the towns south of Central Vil-

lage and east of Willimantic to Fisher's Island Sound. After Mr. Kirk's resignation, March 1st, Mr. E. R. Sherman took that gang and scouted Manchester and East Hartford. All the other towns were scouted by the gang in charge of one of the writers (Mr. Caffrey).

In the towns found to be badly infested the entire area, exclusive of woodlands, was scouted, but where only a slight infestation was encountered the work was confined to the villages, the orchards and along the main highways of travel. All nurseries situated in the towns scouted were given special attention to prevent any possible spread of the pest through the shipping of nursery stock. Pear, apple and white oak trees, situated near lights seemed to be preferred by the pest, and from these trees most of the nests were taken.

The problem of control is increased by the fact that adults are coming in each year from the adjoining states of Massachusetts and Rhode Island and that the large woodland and brush tracts contain nests which are impossible to find and destroy. It seems probable, judging from present conditions, that the insect will gradually spread west and south to include the entire State, unless the natural insect enemies and fungous diseases, combined with spraying and removing the nests, serve to keep the pest in check.

The following is a result of conditions existing in the various towns:

Thompson.

Conditions in the town of Thompson showed considerable improvement over those of the previous year. Nests were taken in nearly the same localities but were not so numerous as in 1912, or so widely scattered. The heaviest part of the infestation is confined to the northern part of the town and to the villages. At Thompson village 184 nests were cut from fruit trees in the vicinity of the four corners near the hotel. Half a mile northeast on the farm of H. B. Ingraham, was the worst infested spot in the entire township, 280 nests being cut from the trees at this place, of which 130 were on one pear tree. Along the road over Brandy Hill and around East Thompson Station, twenty-nine scattered nests were found. Between East Thompson Station and Wilsonville the nests were found in nearly every

orchard, and in one case a group of twenty-five were cut from a small orchard near the State line on the road to Webster, Mass. At Wilsonville, ten nests; Thompson Station, two nests; Grosvenor Dale, ten nests; New Boston, ten nests; Quinebaug, thirty nests. The localities between Quinebaug and New Boston, in the northwest corner of the town, was badly infested, seventy-eight nests coming from this section. West Thompson gave eight nests and the region around Quaddick Reservoir, five nests. Around West Thompson, Mechanicsville and Quaddick the nests were few and widely scattered. A total of 750 nests were gathered in the town of Thompson.

Woodstock.

The eastern and northern parts of the town of Woodstock were found to be badly infested, while more nests were taken in the western part of the town than in any previous year. In the section around Harrisville, 220 nests were cut. Between Pomfret line and South Woodstock the nests were very numerous, especially at Harrington Farm and Potter's, where 300 nests were taken. In the large orchard just east of the Fair Grounds, we found seventy nests; on the estate of Dr. Shepherd, near the lake, two nests; on the estate of Clarence Brunn, two nests, and a few others were scattered about. On the ridge west of Woodstock Pond there were forty-four nests, at the farms of Patrick Mehan and Carl Eke. On Woodstock Hill, Dr. Spaulding's, fifty-four nests, and a few more in the vicinity. To the east of Woodstock Hill the nests were scattered. Just north there were fifty nests opposite the farm of Mr. Lester. At Mr. William Chandler's, East Woodstock, there were ninety nests; one mile east of East Woodstock, on the farm of Mr. Morse, 125 nests, with scattered nests in adjoining orchards. On the May Farm, in the same neighborhood, thirty nests were taken. At Gustavus Johnson's, towards New Boston, there were 132 nests; northwest from Woodstock Hill at Frank Miller's, eighty-one nests; in North Woodstock village several scattered nests were gathered. Two miles northwest of the village, on Thomas Milligan's place, there were 201 nests; around the locality known as "English Neighborhood" the nests were found to be numerous, and in the orchard of Irving Paine, eighty-two nests were taken. At L. H. Healey's, between Woodstock Hill and the road running

east to East Woodstock, twenty-one nests were found; east of West Woodstock at Frank Carlson's, eleven nests. All through this section single nests were found in the orchards connected with the farms. On Bungee Hill, near West Woodstock, at Jarvis Hall farm, there were five nests. In Kenyonville two nests were found, one at the east of the village and one near Crystal Pond.

This makes a total of 2,144 nests in the town of Woodstock.

Putnam.

At Putnam the control measures of previous years have kept the insect from doing serious damage. The caterpillars have not been numerous enough to defoliate the trees or to cause trouble from the "brown-tail rash," which would have been the case if the nests had not been removed each year. Great numbers of the adults are coming in each year from the badly infested districts in Massachusetts and Rhode Island, and this fact makes the problem of control a very difficult one.

The nests were found to be scattered over a greater area than formerly and were not so numerous in the center of the city. The worst infested section in the city was between Front, School and May streets, to the Quinebaug River, where 1,568 nests were cut. Around the Children's Home there were 240 nests; Putnam Heights, ninety-two nests; Rhodesville, forty-one nests; Day Memorial Hospital, ten nests; around Gary school house, twenty-eight nests; Poor Farm, two nests; between Putnam Heights and Rhode Island line, twenty-three nests. Sixty-six nests were cut from the large oak trees on Oak Hill and from the oak trees near Morse Mills, thirty nests. East of Oak Hill only a few nests were taken, and along the northern border of the town no nests were found. Altogether the men destroyed 2,180 nests in the town of Putnam.

Pomfret.

In the town of Pomfret the nests were present in slightly greater numbers than last year and were distributed throughout the entire township. The worst infested place was on the Grosvenor estate, one mile north of Abington post office, where 229 nests were taken. Between the railroad and the stage road to Putnam, the nests were numerous, 211 being cut. West of Gary

school house, thirty-five nests; along the northern town line, sixty-five nests; between Pomfret Street and Eastford town line, 225 nests, which were scattered through the various orchards north of Abington. Solitary nests were found at Dwight Botham's, one and one-quarter miles west of Abington post office; at Dround's, one-half mile to the south; at Smith's, one mile south of Abington; at Edward Peale's, near Abington Station; at Young's, south of Pomfret station; and at Arthur Botham's, one-half mile south of Pomfret station. Forty-eight nests were taken in the Russell orchard just north of the Pomfret-Brooklyn line, adjoining Lapsley's orchards. Four nests were found at Pomfret landing. No nests were taken in the nursery of J. H. Bowditch or its immediate vicinity. A total of 841 nests were found in the town of Pomfret.

Killingly.

In the town of Killingly the nests, although few in number, were found to be distributed throughout the entire township, and were apparently the result of adults coming in from Rhode Island, or from the infested districts in Putnam and Pomfret. Along the ridge of Chestnut Hill, northeast of East Killingly, forty-nine nests were cut. Near Elmville Mill, at Chase's, six nests; at Day farm, midway between Danielson and Williamsville, two nests; and four nests were found about a mile east of South Killingly. In the borough of Danielson, three nests were found along North Street, three nests near the High School, four nests on Broad Street, two nests on Maple Street, in the Brooklyn side of Danielson. Solitary nests were found at house south of Putnam Heights, at first farm south of Putnam town line on East Putnam road, near the Street Railway car barn, near a cottage on south side of Alexander's Pond, at the top of Mashentuck Hill beyond city reservoir, and at Stillwell's, one and one-half miles northeast from East Killingly, making a total of seventy-eight nests in the town of Killingly.

Brooklyn.

The infestation in Brooklyn was confined to the eastern and northern portions of the town. In Lapsley's orchards, near the Pomfret border, twenty-nine nests were cut; one nest at Chapman's on the south side of Bush Hill; nine nests scattered about

the village; three nests on main road, between Brooklyn village and Danielson; twenty-one nests along Allen Hill road and two nests on Brooklyn side of Danielson on Maple Street. Nothing was found in the western part of the town around Axworth Hill or in the region around the southern border of Wauregan. A total of sixty-five nests were gathered in the town of Brooklyn.

Sterling.

No nests were taken in the town of Sterling, although this town must be regarded as infested, because a single nest was found during the scouting operations of 1912. The villages of Oneco, Sterling Station and Sterling were scouted and also the main roads of the town to the north end south of the railroad.

Plainfield.

In the town of Plainfield one nest was taken on the hill to the east of Wauregan village, one nest a mile further north on the main road to Danielson, and one nest in the village of Moosup, just below the Catholic Church. Central Village, Black Hill, Almyville, Plainfield Village and Plainfield Junction were scouted and also along the main roads of the town, but nothing more was discovered. Only three nests were found in the town of Plainfield.

Voluntown.

The village of Voluntown was scouted and along the main road running east. No nests were found.

Griswold.

At Jewett City, in the town of Griswold, thirteen nests were taken from two adjoining yards, on East Main Street, on pear trees. Along North Main Street, two nests were found in two different yards, on apple trees. The villages of Hopeville, Clayville, Pachaug, Doaneville and Glasko were scouted and also the main roads of the town, but no additional nests were found, leaving a record of fifteen nests for the town of Griswold.

North Stonington.

The villages of North Stonington, Pendleton Hill, Laurel Glen and Clark's Falls were scouted, and also along the line of the Norwich and Westerly trolley. No nests were found.

Preston.

Preston Village, Long Society, Preston City, Preston Plains, Preston Mills and Poquetanock were scouted and also along the trolley lines. No nests were found.

Ledyard.

Gales Ferry, Allyn Point and along the road leading to Ledyard village and northward to Preston were scouted, but no nests found. Special attention was given the road along the course of the Yale-Harvard boat race, as many automobiles from infested districts, to the north and east, are parked in this vicinity during the progress of the race and are very liable to bring caterpillars or adults with them. No nests were found in Ledyard.

Stonington.

In the town of Stonington, two nests were found at Stillmanville, just across the Pawcatuck River from Westerly, R. I., and three nests at Downerville in the same locality. While scouting for gypsy moth egg-masses in the borough of Stonington, Mr. Caffrey found one nest in the rear of the Stonington Automobile Station, and one nest at Koelb's, both on Elm Street. In the village of Mystic, forty-six nests were found in four adjoining yards one-quarter mile northeast of the village on the road toward North Stonington. Two nests were found along the main road between Mystic and Stonington borough. No nests were found at Old Mystic, Wequetequock or along the roads to the north. This makes a total of sixty nests in the town of Stonington, and the infestation appears to be an isolated one.

Groton.

In the town of Groton, the villages of West Mystic, Noank, Burnett Corner, Midway, Poquonoc Bridge and Poquonoc Plains, Eastern Point, Groton Town, Mamacoke and around the United States Naval Station, and along the roads fronting the Thames River and the Sound were scouted but no nests found.

New London.

All territory within the limits of the city was scouted. No nests were found.

Waterford.

The main road running north and south between New London and Norwich was followed and the villages of Waterford, Quaker Hill and Bartlett scouted. No nests were found.

Montville.

Uncasville, Kitemaug, Massepeag, Mohegan, Montville Town and Fair Oaks were scouted, and also the main road running north and south. No nests were discovered.

Norwich.

An isolated infestation was discovered in the city of Norwich in May, 1912. At that time all trees were sprayed on which the caterpillars were feeding, and this had the effect of holding the insect in check. One nest was found in the city of Norwich, corner of Willow Street and Broadway. One nest in the Laurel Hill section of Norwich, at 168 Laurel Hill Avenue. The entire town of Norwich was scouted, including Greenville, Taft Station, Taftville, Occum, Yantic, Norwichtown and Thamesville. No additional nests were found at any of these latter places except an old nest on the M. Morgan estate in Thamesville. Only two nests were found in the town of Norwich.

Bozrah.

Bozrah Street, Fitchville, Bozrahville, and along the main roads connecting these villages were scouted. No nests were found, but Mr. D. M. Rogers reports that one of his men (Mr. Vinton) observed a nest in this town.

Lisbon.

With the exception of a few houses along the northern border, the entire town of Lisbon, including Newent, Jewett Station and the Lisbon side of Jewett City, was scouted. No nests were found.

Sprague.

The entire town of Sprague was covered, including Baltic, Versailles, Versailles Station and Hanover. In an orchard beside the road, one-quarter mile east from Hanover, three nests were found.

Franklin.

Franklin Station, Franklin Village, North Franklin, Avery Hill, Pleasure Hill, Franklin side of Yantic and all main roads connecting these villages were scouted. No nests were found.

Canterbury.

In the town of Canterbury, Packersville was scouted, as were the main road to Canterbury Village from Packersville and all roads in the vicinity of the village and Westminster. No nests were found.

Scotland.

The main road from Windham, Scotland Village with surroundings, and the road to Scotland Station were scouted. No nests were found.

Windham.

The entire town of Windham was scouted very carefully, as the vicinity of Willimantic was looked upon as a danger spot, due to the fact that it is a junction point of many railroads. Windham Center, North Windham, South Windham, and all roads in the town were also scouted. One nest was taken at Windham Center on the property of J. H. Lockman, this being the only nest found in the town of Windham.

Hampton.

At Hampton Village, seventy-one nests were cut from a group of old apple trees near the post office; two nests along the road to the railroad station, and one nest one and one-half miles north-east of the village on the road to Elliotts. No nests were taken at Clark's Corner, at Hampton Station, or in the northern part of the town. Thus seventy-four nests were destroyed in the town of Hampton.

Chaplin.

The entire town of Chaplin was scouted, except the northwestern corner. No nests were found.

Mansfield.

One nest was taken at Mansfield Hollow, near the cross roads, on a pear tree in the yard of Mr. Bowers. One nest was found

near the trolley line between Willimantic and South Coventry, in the southwest corner of the town of Mansfield, on the property of Philip Bergevin, corner Babcock Hill Road. In addition Professor G. H. Lamson reported one nest from the college orchard at Storrs, and one nest at Mansfield Four Corners. No nests were found at Eagleville, Mansfield Depot, Spring Hill, Hank Hill, Gurleyville, Chaffeeville or Mansfield Center. A total of four nests were gathered in the town of Mansfield.

Eastford.

Phoenixville, Eastford Village, North Ashford, and the roads connecting these villages were scouted. One nest was taken in Eastford Village on the property of George Griggs; one nest in Phoenixville, at John McNair's, on top of the hill east of the village, making two nests for the town of Eastford.

Ashford.

The villages of Westford, Westford Hill, North Ashford, Warrenville and Ashford were scouted. No nests were found.

Union.

The village of Union and roads leading east to Woodstock, west to Stafford and north through Mashapaug were scouted. A nest was found on the first farm south of the Wells property, making one nest for the town of Union.

Stafford.

At Stafford Springs, one nest was taken on the property of Mr. Fox, West Street; one nest near the fair grounds at the second house north of the railroad crossing; one nest in town park and one nest on top of hill along the road leading to Staffordville. Nothing was found at West Stafford, Ellithorpe, Orcuttville, Haydensville, Stafford Village or Staffordsville. This gives a total of four nests in the town of Stafford.

Somers.

Two nests were taken at Somerville in front of Trolley Station No. 40, on apple trees beside the road; one nest in Somers Village, near Trolley Station No. 50, on an apple tree beside the road, and two nests at the fork of the roads one-quarter mile

due south of the village. At North Somers, one nest was taken on the farm of Percey E. Giffey, near the state line, making six nests in the town of Somers.

Enfield.

In the town of Enfield, one nest was found on the property of Herbert Chilson, three-quarters of a mile south of the State line on the main road to Springfield; one nest on property of F. St. George, Maple Street, near the main road; one nest one-quarter mile due east of the Warehouse Point railroad station, on Enfield Street; two nests in Hazardville, at corner Main and Bridge Streets, and one nest along the trolley line one mile east of Thompsonville, on an apple tree near the roadside. Nothing was found at Thompsonville, Enfield Village, Shakers Station, Shakers Village or Scitico. A total of six nests were found in the town of Enfield.

Willington.

West Willington, Willington Village, East Willington, South Willington and the roads connecting them were scouted but no nests found.

Tolland.

The village of Tolland was scouted as well as the roads to the north and south of the village and east to the railroad. No nests were found.

Ellington.

Ellington Village, Sadd's Mills, Crystal Lake, Windemere, and the main roads of the town were scouted but no nests found.

East Windsor.

Warehouse Point was scouted, including the region around Prospect Hill, also the main road along the river toward East Hartford. At Broad Brook, one nest was taken at Marian's farm, on the Hartford road, one-quarter mile south of the village; one nest at Twombly's, just east of the railroad crossing near the station; and one nest at H. W. Reed's on Main Street. Nothing was found at Melrose or vicinity. A total of three nests were taken in the town of East Windsor.

Coventry.

South Coventry, North Coventry, the section around Bald Hill, South Coventry Station and the main roads of the town were scouted. One nest was found one-half mile north of South Coventry, on Ripley Hill, at corner of the road to Eagleville, this being the only nest found in the town of Coventry.

Bolton.

The entire town of Bolton was scouted, including Bolton Notch, Quarryville, and Bolton Village. Special attention was given the nursery of J. Wesson Phelps and vicinity. No nests were found in the town.

Vernon.

The city of Rockville and vicinity was scouted and one nest taken from a pear tree near the corner of Prospect and Mountain Streets, where a high concrete wall abuts the trolley tracks. Vernon Center, Vernon Station, and Talcottville were also scouted but no additional nests found. Only one nest was found in the town of Vernon.

Manchester.

The entire town of Manchester was scouted, including Buckland, Manchester Village, Manchester Green and South Manchester. Special attention was given the nursery of C. R. Burr & Co., the stock being examined very carefully to prevent any possible spread of the insect through the medium of nursery stock. No nests were found in the town.

South Windsor.

East Windsor Hill, South Windsor, the main road along the river, section around South Windsor Station, Wapping and vicinity were scouted. The nursery stock of C. R. Burr & Co., between Wapping and Buckland was also examined, but no nests were found.

East Hartford.

In East Hartford, at 63 Connecticut Boulevard, twenty nests were cut from three pear trees and one apple tree; at No. 494 Main Street, nine nests were cut from five pear trees. The remainder of that town, including Burnham and Burnside, was scouted but no additional nests found, making a total of twenty-nine nests in the town of East Hartford.

Wethersfield.

The village of Wethersfield and vicinity was scouted and as far south as Maple Street, also around the State prison and all roads north of the town line. No nests were found.

Hartford.

The entire city of Hartford was systematically scouted. A bad infestation was discovered in the square bounded by Main, Park, John, and Buckingham Streets, on a group of large pear trees. From the number of old nests and pupa cases found it seems probable that this colony had been present in the city for at least two years. The worst infested yard was in the rear of 239 Main Street, where 456 nests were cut from nine pear trees, one tree alone containing 221 nests. In the adjoining yard 173 nests were cut from three pear trees, six nests from an elm and four nests from a plum tree. The writer visited the place on March 11, in company with Mr. G. A. Parker, Superintendent of Parks; Mr. W. A. Muirhead, Superintendent of Trees, and several other city officials and employees, so that the men who are engaged in park and tree work in the City of Hartford, might become familiar with the appearance of the nests. Some of the infested trees are shown on plate I, b. Scattering nests were found throughout this square and on the opposite sides of Main and John Streets. The remaining nests found in the city were widely scattered and seemed to be the result of adults coming from the badly infested section. Solitary nests were found at No. 49 Elmer Street, near corner Capen Street and Windsor Avenue, at 281 Trumbull Street, at corner Charter Oak Avenue, and Governor Street, at corner Hudson and Buckingham Streets, at corner Washington and Madison Streets, at corner Wyllys Street and Wethersfield Avenue, at 14 Wyllys Street, at 23 Charter Oak Place, at 25 Wyllys Street, at 84 Maple Street, and six nests along east side of Buckingham Street. No nests were found in any of the various nurseries throughout the city or in any of the public parks. A total of 747 nests, therefore, were found in the City of Hartford.

West Hartford.

All territory within the town limits of West Hartford was scouted. At C. W. Hall's, 239 North Main Street, four nests

were taken and one nest at Fred Bishop's, opposite the corner of Farmington and Outlook Avenues. Mr. N. A. Millane, Superintendent of The Frost & Bartlett Co., tree specialists, had previously sent a nest to the office, which he found while renovating the apple orchard of R. J. Jacobs on the Mountain Road. No other nests were found in this orchard or in the immediate vicinity. A total of six nests were found in the town of West Hartford.

Farmington.

The villages of Unionville and Farmington were scouted with the main road connecting these villages with West Hartford. No nests were found.

Windsor.

The villages of Windsor, Hayden's, Poquonock and Rainbow were scouted; also the main road from Windsor Locks to Hartford and the road from Rainbow to Windsor. One nest was taken on Spring Street in the village of Windsor, this being the only one found in the town.

Bloomfield.

The village of Bloomfield was scouted and all territory in the southeastern corner of the town. No nests were found.

Windsor Locks.

The entire town of Windsor Locks was scouted, but no nests were found.

Suffield.

In the town of Suffield, a badly infested section was discovered just west of the Fair Grounds, near the corner of West Suffield Road and Hasting's Hill Road. In this section 300 nests were cut from a group of high apple trees at Arnold's and 245 nests from apple, pear and wild cherry trees on the farms of Burke, Leach and Grey. Three nests were found around Hasting's Hill crossroads and scattering nests along Hasting's Hill Road north and south of that point. Solitary nests were taken at William Orr's, on Grant Street, at Charles Adams on Ratley Street, at Lily's, one-quarter mile due south from West Suffield crossroads, at Fuller's corner, at corner North Street and Halladay Avenue,

at corner North and Hickory Streets; near northeastern end of Thompsonville bridge; at Bowker's, near Stony Brook bridge; at Pinney estate on Prospect Hill; at estate opposite Kent's Corner; three nests along South Street and two nests beside the railroad tracks south of the station, making a total of 565 nests for the town of Suffield.

Lebanon.

All territory in the northern and eastern part of Lebanon was scouted, including Lebanon Village, Lebanon Street, Lebanon Station, Chestnut Hill, Liberty Hill, Leonard Bridge and the Lebanon side of Bozrahville. A great number of apple trees were present in the vicinity of Lebanon Street. No nests were found in the town.

Columbia.

The territory scouted consisted of the road running from Chestnut Hill through Columbia village as far as Columbia reservoir, thence along the next road south to Leonard Bridge. Also along the road running south of the railroad through Hop River village to Willimantic. No nests were found.

Andover.

Andover Station and vicinity was scouted, and also the road coming from Bolton Notch toward Hop River and along the main road south to Hebron. No nests were found.

Hebron.

Gilead, Hebron Village and Turnerville were scouted, with the main roads connecting these villages. No nests were found.

Colchester.

All territory within the radius of a mile from the railroad station was scouted in the village of Colchester. No nests were found.

Middletown.

In Middletown the city was scouted on the west to the freight yards, Johnson Street, Prospect Street and the Air Line railroad tracks; on the south to Baldwin Street, Park Street, Fountain Avenue and High Street; on the east as far as Warwick Street

to Durham Avenue and Farm Hill Road. In addition, the region known as South Farms was scouted as far as the grounds surrounding the Insane Asylum. No nests were found.

New Britain.

The City of New Britain was scouted on the north to Broad Street, Lasalle Street and Fairview Cemetery; on the west to Burritt Street, Black Rock Road and Lincoln Street; on the south to Shuttle Meadow Road and Brook Street, and on the east to the side streets branching from East Street. No nests were found.

Saybrook Junction.

The territory scouted included all that portion of the village north of the railroad tracks, west to Trolley Station No. 57, near Oyster River, south to the road leading to North Cove and east to the river. No nests were found.

SUMMARY.

The result of control measures against the brown-tail moth in Connecticut during the past winter indicates that the area known to be infested has been greatly increased since last year and now includes over twenty-seven towns in that portion of the State lying east of Suffield and West Hartford, and north of West Hartford, Willimantic and Jewett City, with separate infestations at Norwich and Stonington. The number of nests have slightly increased in some of the towns where the insect had previously been known to occur, and in addition large infestations were found at Hartford and Suffield. The other towns in the list are infested only to a slight degree.

It should be borne in mind that in this work described in the foregoing pages, as has already been stated, the open country only was carefully examined, particular attention being given to the fruit trees in orchards and around dwelling houses and along the highways.

The brown-tail moth also attacks oak trees in the woodlands, but on account of the leaves hanging upon these trees it is almost impossible to detect the nests. Moreover, many of them are so far from the ground that it would be very expensive to reach them. For these reasons, it is impracticable to scout the entire

State and destroy the nests. In the future local work must be done by property owners, and the city and town authorities. Some law requiring this, and similar to the Massachusetts and New Hampshire laws, will probably be found necessary.

The following figures show the record of the nests actually found in each town and destroyed. In Windham County this work has been done for three years and the figures for each year are given. Most of the other towns named in the list have not previously been examined for nests, and many towns not included in the list have also been scouted and no pests found.

NUMBER OF WINTER NESTS DESTROYED.

Hartford County.

	1911	1912	1913
Enfield	..	..	6
Hartford	..	..	747
East Hartford	..	..	29
West Hartford	..	..	6
Suffield	..	..	565
Windsor	..	..	1
East Windsor	..	..	3

Tolland County.

Coventry	..	..	1
Mansfield	..	..	4
Somers	..	..	6
Stafford	..	1	4
Union	..	..	1
Vernon	..	..	1

Windham County.

Brooklyn	..	35	65
Eastford	..	..	2
Hampton	..	..	74
Killingly	6	27	78
Plainfield	..	13	3
Pomfret	89	82	841
Putnam	5,989	1,260	2,180
Sterling	..	1	..
Thompson	112	966	750
Windham	..	..	1
Woodstock	937	699	2,144

New London County.

Bozrah	..	..	..*
Griswold	..	..	15

* Reported by Mr. Vinton to D. M. Rogers.

	1911	1912	1913
Norwich	..	..	2
Sprague	..	..	3
Stonington	..	..	60
Total	7,133	3,084	7,592

FEDERAL QUARANTINE IN CONNECTICUT.

On account of the presence of the brown-tail moth in Connecticut, and the danger of spreading this insect by shipping nursery stock, a quarantine was established by the Federal Horticultural Board, becoming effective on and after November 25, 1912, and including in Connecticut the towns of Stafford, Union, Woodstock, Thompson, Pomfret, Putnam and Killingly. Nursery stock within this area could not be shipped outside of it, unless inspected at the time of packing, and duly certified by a Federal inspector. On June 12, 1913, a hearing was held in Washington, D. C., before the Federal Horticultural Board, relative to extending the quarantine lines to coincide with the present infested area. The entomologist attended this hearing and showed by means of a map the location of the infested towns and names which were given in a separate list. The quarantine was therefore extended to take effect August 1st, 1913, and to include Suffield, Windsor Locks, Windsor, Bloomfield, West Hartford, Hartford, East Hartford, Manchester, Bolton, Coventry, Windham, Franklin, Bozrah, Norwich, Preston, North Stonington, Stonington, and all territory north and east of these towns within the State of Connecticut.

All persons within the quarantined area desiring to ship nursery stock outside of this territory should apply to Mr. D. M. Rogers, 43 Tremont Street, Boston, Mass. To accommodate nurserymen one or more Federal inspectors will be stationed in Connecticut during the shipping season.

The infested towns, as well as the quarantined area are shown by the map on plate I, a.

INTRODUCTION OF INSECT PARASITES INTO CONNECTICUT.

The Federal authorities, in coöperation with the State of Massachusetts, have been instrumental in collecting and importing into this country all the parasites known to attack both the gypsy and brown-tail moths in the various European and Asiatic

countries where these moths occur. Some of these parasites have been reared in large numbers at the parasite laboratory at Melrose Highlands, Mass., have been liberated in Massachusetts and the other infested states, and have already survived several New England winters.

In Connecticut we aim to exterminate the gypsy moth in the small isolated colonies at Wallingford and Stonington, but the brown-tail moth is spreading into the State with considerable rapidity from a large infested area covering the whole of Rhode Island, the greater portion of Massachusetts, the eastern part of Vermont, nearly all of New Hampshire and Southern Maine. Both sexes fly, and a gale during the first half of July, when the adults are flying, will often carry large numbers of the moths in the direction of the prevailing winds. Extermination through artificial measures is, therefore, out of the question, and we must aim to check its spread and to control it by reducing its numbers to the minimum; then it will be much less serious as a pest. One of the most promising methods of control is through its natural enemies. In the report of this Station for 1910, page 689, mention is made of the fact that a native fungus, *Empusa aulicæ* Reichardt, attacks and kills a large proportion of brown-tail caterpillars in moist seasons.

One of the most effective of the introduced parasites is a small hymenopterous or four-winged fly of the family Ichneumonidæ, *Apanteles lacteicolor* Vier., which attacks the hibernating caterpillars. This species was colonized in Massachusetts in 1908, specimens have been recovered each year since 1909, and it withstands our climate and spreads widely. In 1912, Mr. A. F. Burgess of the Bureau of Entomology, who has charge of this work at Melrose Highlands, Mass., had a colony of about 1,000 individuals planted at Putnam, Conn. In 1913, this parasite was recovered from nests collected by Mr. Caffrey in Thompson, Woodstock, Pomfret, Somers and Stafford. In 1913, additional colonies were planted in Hartford, Suffield, Mansfield, Hampton, Danielson, Plainfield, Griswold, Norwich and Stonington.

A two-winged or Dipterous fly of the family Tachinidæ, *Comptosilura concinnata* Meig., parasitizes both the gypsy and brown-tail caterpillars and seems to be well established and spreading freely in Massachusetts. A colony of over 600 of these flies was

planted in Putnam, Conn., in 1912. We have no records to show that it has been recovered. An additional colony of this species was planted in Hartford in 1913.

The planting of these effective parasites along the boundary of the infestation, will doubtless reduce the numbers of brown-tail moths and thus check its spread southward and westward. These parasites cannot prove harmful in any way. The former (*Apanteles*) attacks our native caterpillars of the genera *Datana* and *Hyphantria* (fall web-worm) and the latter (*Compsilura*) has been reared from the tussock moth, the fall web-worm and the imported cabbage worm, all of which we would like to see reduced in numbers.

A LEPIDOPTEROUS LEAF-FOLDER ON PRIVET.

Archips rosana Linn.

BY B. H. WALDEN.

Many privet hedges in New Haven were attacked during May, 1913, by larvæ which tied together the terminal leaves, forming an enclosure within which they fed. As privet foliage is seldom troubled by insects, it seemed probable that the species might prove interesting, so material was collected and adults reared. The adult proved to be a Tortricid moth and specimens were sent to Mr. W. D. Kearfott, who determined the species as *Archips rosana* Linn.

Archips rosana is a species introduced from Europe and the first economic mention of it in this country is by Messrs Comstock and Slingerland, who described and figured it as a pest of currants. (Cornell Univ. Agr. Expt. Sta., Bull. XXIII, pp. 119-121, 1890.) In bulletin 27, n. s., Division of Entomology, p. 88, 1901, Dr. Chittenden mentions this insect as the "Rose Leaf-folder" and states that while the species attacks roses, it is not particularly troublesome, but may become a pest at any time.

Professor C. H. Fernald lists the following as food plants of this species in Europe,—Apple, Elm, Willow, Birch, Wild Rose, Raspberry, Hazel, Linden, Aspen, Hawthorn, Currant and Gooseberry. (Trans. Amer. Soc., Vol. X, p. 11, 1882.)

Mr. Kearfott states in his letter that he has examined material bred from blackberry and currants; he also states that while

the species exists in colonies in a few localities, it does not seem to be common in North America.

During the past season a few larvæ were found on roses planted next to a badly infested privet hedge, but the insect showed a decided preference for the privet.

On the Station grounds, gooseberry, black and red currants were found slightly infested with larvæ which appeared to be those of *Archips rosana*, but as the material collected was parasitized, no adults were reared. No larvæ were observed on the blackberries which were growing nearby.

ABUNDANCE.

On May 20th, the writer, at the request of the owner, examined a privet hedge on Canner Street. The hedge was about one hundred and fifty feet long, and while generally infested the infestation was worse on a portion which was in partial shade. Here nearly every tip was infested. On June 5th, another hedge in the same neighborhood was examined and nearly every tip found infested. Reports of other badly infested hedges in the vicinity were received. A hedge about a mile and a half away showed the work of the insect and every hedge examined between these two points was found to be more or less infested.

LIFE HISTORY AND HABITS.

The eggs are laid on the twigs in small, flattened, oval masses, covered with a dull, waxy substance. When first laid, the mass is light green in color but changes to gray later in the season. The masses laid in the breeding cage varied from about 3 mm. ($\frac{1}{8}$ inch) to 8 mm. ($\frac{1}{2}$ inch) in length and contained from twenty-four to eighty-one eggs.

The eggs were first observed in the breeding cage June 19, where they were laid on the glass. Egg masses were also found on fence posts near the infested hedges.

The eggs hatch from about the first to the middle of May, depending upon the season. Those observed by Messrs. Comstock and Slingerland hatched during the last days of April. The larvæ, when observed on May 20th, varied from 4 mm. to 13.5 mm. in length, and the smaller ones were white in color with the head, thoracic shield and legs black.

The larva feeds on the tips of the growth where it draws two or more leaves together with fine silken threads, thus forming an enclosure within which a single larva feeds. When disturbed the larva will drop down on a thread similar to a canker worm.

The full-grown larva is dull apple-green in color, head dark brown, nearly black. Thoracic shield with the posterior third dark brown, becoming lighter towards the anterior margin. Legs with the basal joints green, the two remaining joints brownish. Average length 19 mm., average width 2.5 mm., width of head 1.75 mm. Body slightly flattened, sides nearly parallel; the last two anal segments slightly narrowed.

The larva pupates in the enclosed leaves. The pupa is about 12 to 13 mm. ($\frac{1}{2}$ inch) long, light brown in color, and each of the abdominal segments bear dorsally two transverse rows of blunt spines which project backwards. The last segment is long and tapering with eight long slender hooks at the end; four at the extreme tip and two slightly back of these on either side.

The pupa wriggles vigorously when disturbed. When the adult is ready to emerge the pupa pushes about two-thirds out of the enclosed leaves, holding to them by means of the hooks at the end. The first pupæ were found in the breeding cage on June 3d. More material was collected June 5th, which contained thirty-one larvæ and six pupæ. The first adults were obtained June 10th and continued to emerge until after the 20th of June.

The adult moth has a wing spread of from 18 to 22 mm. ($\frac{3}{4}$ to $\frac{7}{8}$ of an inch). The color and markings are quite variable. The fore wings are light to olive-brown crossed with darker markings; the rear wings in the darker specimens are of a uniform dusky color, while in the lighter specimens the outer third is of a light yellowish brown color.

There is but one brood each year. The winter is passed in the egg stage, the eggs being laid on the twigs during the latter half of June and hatch about the first of the following May. The larvæ become full grown in about a month, pupating soon after the first of June, the adults emerge from eight to twelve days later.

The larva, pupa, adult and folded privet leaves are shown on plates III and IV.

PARASITES.

Many of the larvæ, when nearly grown, had eggs of Tachinid flies deposited upon the head and first segment of the body, this being the portion of the larva that was exposed while feeding. Of fifty-three larvæ collected on June 5th and 6th, eighteen, or about thirty-four per cent., were thus parasitized. Tachinid flies began to emerge from this material on June 18th. The specimens were determined by Mr. Harrison E. Smith of the Bureau of Entomology, as *Exorista pyste* Walk. From the material collected on gooseberry there emerged small Hymenopterous parasites, which have not yet been determined.

TREATMENT.

This insect will hardly prove a serious pest of privet hedges, as the common practice of trimming the hedges will remove most of the infested tips, which should be gathered and destroyed to kill the larvæ. Some of the larvæ will spin down to the ground when disturbed and later return to the plants. The hedges should be examined after a few days and any infested tips should be removed. In some cases it may be advisable to trim the hedge somewhat earlier than if it were not infested. Should this insect become troublesome on currants and gooseberries it may be controlled by a thorough spraying with lead arsenate at the rate of two pounds in fifty gallons of water, soon after the leaves unfold. This treatment will also keep the currant worm in check. Where it is not advisable to spray, hand picking will be the only remedy.

UNUSUAL ABUNDANCE OF THE APPLE-TREE
TENT-CATERPILLAR.

Malacosoma (Clisiocampa) americana Fabr.

This insect, which is usually common on apple and wild cherry trees along the roadsides and hedge rows, was probably more abundant in 1913 than in any other season in recent years. The year of 1902 was a "caterpillar year" and bulletin 139 was issued to supply information regarding the pest and how to combat it. This bulletin was reprinted in the report of this Station for 1902, page 139, but has long been out of print.

Following 1902, tent-caterpillars decreased in abundance and for several years were not much in evidence, and did no damage. In 1911 and 1912 they were on the increase and a number of specimens and inquiries regarding them were received from various parts of the state.

Early in 1913 many egg-clusters were sent in, and when the trees put out their leaves in May it was evident that 1913 was a "caterpillar year," there being more nests or tents than in any year since 1902. In New Haven the nests were not very abundant, but back a few miles from the coast every neglected apple tree, every black cherry tree and every choke cherry bush, had from one to fifteen or twenty nests, and many apple trees were entirely stripped. At Stonington, which is a coast town, the caterpillars were extremely abundant and many trees were stripped. In Litchfield county the nests were very abundant. They were so reported from Salisbury and Norfolk and the writer observed them in portions of Roxbury, Woodbury and Washington, as well as in Waterbury, Middlebury and Southbury of New Haven County. Nearly all the roadside apple and wild cherry trees as well as the neglected orchards were stripped. In Newtown, nests were so abundant that prizes were offered for their destruction.

During the year samples of the tent-caterpillar were received at this office from Union, East Woodstock, East Hampton, Torrington, Salisbury, Woodbury, East Granby, Stepney Depot, New London, Madison, Guilford and New Haven. Many inquiries were also received unaccompanied by specimens.

Specimens of the forest tent-caterpillar, *Malacosoma disstria* Hbn., were received from Wallingford and Salisbury.

The great abundance of tent-caterpillars and the fact that bulletin 139 is out of print, led to the preparation of a new publication on the subject, which appeared in August as bulletin 177, and gave a full account of the insect. This bulletin contained twenty pages and seventeen illustrations and was distributed to the names on the regular mailing list of the Station. Copies were also sent to many correspondents.

Tent-caterpillars were abundant at Wallingford and at Stonington and crawled under the gypsy moth bands to make their cocoons. On June 23, the men in charge of the work at these places were instructed to collect all cocoons found under the

bands, and these were brought to the laboratory for the purpose of rearing parasites. Moths emerged from two-thirds of the cocoons gathered at Wallingford, but of those collected at Stonington, more than two-fifths or nearly one-half were parasitized. Of 354 cocoons collected at Stonington, 140 gave ichneumon flies, seven Tachinid flies, and the moths emerged from 207 cocoons. A large proportion of the ichneumon flies belonged to the genus *Pimpla*, *P. conquisitor* Say., being one of the commonest species.

Bulletin 177 cannot be reproduced in this report. Those desiring the detailed account of the insect should send for it. For the convenience of the reader some of the illustrations are shown on plates V and VI and the summary is given below.

SUMMARY OF BULLETIN 177.

1. The apple-tree tent-caterpillar, a native insect and one of the chief leaf-eating enemies of the orchard, has been very abundant throughout Connecticut the present season and has injured fruit trees by defoliating them in May. Wild cherry is probably the natural food of the species, but when abundant it attacks apple and other fruit trees.

2. Eggs are laid on the twigs of the food plant in summer and hatch the following April. After a few days the young caterpillars form on the branches a nest in which they live, going out from it to feed. They are always within the nest at night and in cloudy weather. They become full-grown in about six weeks and spin white silken cocoons from which the adults emerge two weeks later.

3. The small grey eggs are deposited in masses of 200 or more encircling the twigs, and are covered with a brownish substance. The full-grown caterpillar is over two inches long, black above and below, and blue on the sides, with a white stripe along the back. It is thinly covered with light brown hairs. The white cocoon is about one inch in length and half an inch in thickness. The adult is a reddish brown moth with two whitish stripes extending obliquely across each fore wing.

4. The species is usually held in check by its natural enemies, which consist of several kinds of birds, parasitic insects and a bacterial disease.

5. The remedies are: to gather and destroy the egg-masses during the winter months; an effective method of accomplishing this is to offer a bounty or prizes to school children for them; spray when the leaves appear, using three pounds of lead arsenate or one-half pound of Paris green to 50 gallons of water or Bordeaux mixture; if impracticable to spray, brush off the nests as soon as they can be found, choosing the early morning or cloudy weather, when the cater-

pillars are inside the nests; burning the nests on the trees is not to be recommended.

SCARCITY OF WHITE GRUBS IN 1913.

White grubs were extremely abundant in Connecticut in 1912, and caused great injury to grass lands, and to such cultivated crops as strawberries, corn and potatoes. An illustrated account of this damage was given in the report of this Station for 1912, page 288.

Many growers feared similar damage in 1913, though it was explained to correspondents that the large or nearly mature grubs caused most of the damage and that they would become fully grown and transform to beetles, and therefore, would not be able to injure the roots of plants in 1913. The possibility was mentioned, however, of a younger brood causing damage, and it was with some interest that we watched results.

At the Station farm at Mt. Carmel a grass field was plowed in April. The field had been in grass for many years and was "run out" and needed tillage and fertilizing. It was on this field that the cabbage plants mentioned on page 232 were set on April 25th. White grubs were not noticed in the soil, but small June beetles, probably *Lachnosterna tristis* Fabr., were extremely numerous in the ground, though many had been crushed in the operations of plowing and harrowing.

Few complaints of white grub injury were received in the correspondence of this office in 1913. In order to collect information on this point the following letter was mailed to fifteen correspondents in various parts of the state who reported damage in 1912:

"Last year in correspondence with this office you reported considerable injury to fields and crops in your vicinity from the attacks of white grubs. Were these insects sufficiently abundant to injure your crops in 1913?

I shall appreciate a prompt reply in the inclosed stamped and addressed envelope, giving your own experience and observations."

Of the thirteen replies received, only one reported damage, and this was to a field of strawberries set in the spring of 1913. Potatoes were also slightly eaten. Most of the correspondents stated that not only were their own crops unmolested, but that

they had not heard of any damage this year in their vicinity, where their neighbors' crops were greatly damaged in 1912.

As the grubs were so abundant in 1912, we fairly expected the adult beetles to be correspondingly abundant in 1913. Such, however, was apparently not the case.

On the evening of May 3d, which was a warm day, in the writer's own garden the beetles emerged in such abundance that they made a conspicuous humming noise in the trees. As this was the first appearance of the adults only one or two specimens were collected, as it was expected that they would continue to be abundant. These have been identified by Mr. John J. Davis of the Bureau of Entomology as *Lachnosterna fraterna* Harr. and *L. fusca* Fröhl. A period of cool weather followed, however, and the beetles disappeared and were not again abundant. In fact, very few adult June beetles were collected or seen afterwards, during the season.

TAXUS PLANTS IN NURSERY INJURED BY A WEEVIL.

Otiorhynchus sulcatus Fabr.

On April 2, 1913, Mr. D. J. Caffrey was shown in the nursery of James H. Bowditch at Pomfret some plants of Japanese yew, *Taxus cuspidata* var. *brevifolia*, which had been injured by an insect which devoured the small roots, and girdled both the larger ones and the main stem below the surface of the ground.

The foreman, Mr. Baker, stated that in 1912, in a plot of 150 plants worth \$1.50 each, more than 100 plants were killed, and others injured by this insect, which had been more or less troublesome for at least five years, and probably for six or seven. Mr. Baker further stated that altogether this grub had caused them several hundred dollars damage and had attacked all the different kinds of yew grown in the nursery, though apparently preferring the Washington, Weeping and Japanese varieties. He had also found *Retinospora ericoides* somewhat injured.

Mr. Caffrey collected specimens, but as his work kept him elsewhere, they were not brought to the laboratory for several days, and were then all dead. We recognized the grubs as the larvæ of a curculionid beetle, but could not accurately identify the species without the adults.

In response to our request for more material, Mr. Baker sent two *Taxus* plants and a box of soil containing about twenty-five larvæ, some of which appeared to be nearly full grown, and a few had already made cells in which to transform. This material was received April 11, and the plants were set in the soil accompanying them in a large breeding cage in the insectary.

On April 22 and 23, several adults emerged and we recognized the species as *Otiorhynchus sulcatus* Fabr., which is shown on plate VII, b.

A similar injury to the roots of young hemlocks was recorded in the report of this Station for 1909, page 370, caused by another species of the same genus *Otiorhynchus ovatus* Linn., commonly known as the strawberry crown girdler. Both *ovatus* and *sulcatus* are European species and the latter is recorded* as injuring *Taxus* and *Rhododendron* plants in Europe. Miss Ormerod reported the species as seriously injuring twelve acres of beets in England,† and it has attacked various other vegetable crops in Europe, but so far has not been generally considered as a particularly destructive insect in America. It has attacked garden vegetables occasionally causing injury, in both its larval and adult stages. In New York State the late Dr. J. A. Lintner considered *sulcatus* a rare species,‡ but in 1897 it was found injuring strawberry plants at Rochester, N. Y.§

Otiorhynchus sulcatus has been recorded as injuring grape vines and has been called the "black vine weevil" and the "black fruit weevil." The late Dr. James Fletcher of Canada received examples from Victoria, B. C., which were feeding upon the roots of cyclamens in greenhouses.|| Johannsen has also recorded injury to cyclamens in Maine.¶ The adults have been known to feed upon the fronds of ferns.** Forbes states†† that "this European species seems not to thrive in the United States" and that it is comparatively rare in this country.

* Reh, Handbuch der Pflanzenkrankheiten, Die tierischen Feinde III, p: 542, 1913.

† Manual of Injurious Insects and Methods of Prevention, p. 361, 1890.

‡ Report New York State Entomologist, X, p. 419, 1894.

§ Report New York State Entomologist, XIII, p. 374, 1897.

|| Insect Life, Vol. VI, p. 284, 1894.

¶ Maine Agr. Expt. Station, Bull. 187, p. 8, 1911.

** Insect Life, Vol. IV, p. 222, 1892.

†† Report of Illinois State Entomologist, XXI, p. 144, 1900.

In Smith's Insects of New Jersey, 1909, *O. sulcatus* is listed as occurring in New Jersey "under hemlock bark."

The adult is one of the snout beetles or weevils and is three-eighths to one-half inch in length, color dark brown or black, marked with scattering spots of light brown pubescence. There is much variation but the pubescence usually extends all over the beetle, including legs, antennæ and head. The thorax and elytra are rough. The proboscis has a groove or sulcus down the front.

This insect is shown in its larval, pupal and adult stages, natural size, on plate VIII, b. The Station collection contains specimens from New Canaan, Litchfield, Middletown, Pomfret and New Haven.

It is doubtful if any treatment can be successfully applied to prevent further injury to *Taxus* by this insect, but possibly carbon disulphide injected into the ground around the plants in late summer might kill the larvæ before they had seriously injured the plants.

FIELD TESTS IN CONTROLLING CERTAIN INSECTS ATTACKING VEGETABLE CROPS.

By W. E. BRITTON AND B. H. WALDEN.

THE CABBAGE MAGGOT, *Pegomya brassicæ* Bouché.

At the Station farm at Mt. Carmel, 950 cabbage plants were set on April 25, on new ground plowed in the spring and thoroughly pulverized with the disk harrow. The plants were set in five rows, each row nearly 350 feet in length, and containing 190 plants. The rows extended nearly north and south and adjoined the old apple orchard where spraying tests have been conducted for the past three seasons. The varieties were Early Summer, two rows; Wakefield, one row; Succession, two rows, and All Seasons, one row.

A section crossing the five rows, being approximately the second fourth of the area starting from the south end, was selected for applying tar paper disks. This section contained fifty-one plants per row, or a total of 255 plants. The disks were cut in the form of hexagons, four inches in diameter, from single ply

tar paper and were placed on the stems of the plants at the time of setting.

Some of the plants were "damping off" at the time of setting and some failed to recover. For this reason there were some vacancies or "missing plants." Later, the cabbage maggot attacked and killed others. A few plants headed and were harvested without keeping a record. When the plants were finally examined on June 7, their condition was as follows:

Untreated	31 per cent. missing.
Disked	15 " " "

Of the remaining plants maggots had attacked a much greater proportion of the untreated ones, as the following figures show:

Untreated	12.0 per cent. maggoty.
Disked	0.05 " " "

THE CABBAGE APHIS, *Aphis brassicæ* Linn.

This insect was troublesome in many cabbage fields in Connecticut in 1913 and appeared in such numbers on some of the plants at the Station farm that Mr. Ripley sprayed the infested plants on August 14, using "Black Leaf 40" at the rate of one teaspoonful to a gallon of water, with soap added to act as a spreader. When examined, the next day, it appeared that all aphids which had been hit by the spray were dead.

THE ONION THRIPS, *Thrips tabaci* Linde.

During the past few seasons, onions in Connecticut have been seriously attacked by the onion thrips. In several instances the growers have given up raising onions on account of this pest.

Early in the season experiments were planned to combat the onion thrips. A grower in Wethersfield offered the use of his field and to coöperate with us by furnishing help to do the work and an outfit to do the spraying. The experiments were not carried out as planned for several reasons, the most important of which were, lack of assistants who could look after the work at the proper time, difficulty in obtaining an adequate outfit for spraying the onions and a scarcity of help which could be obtained by the owner at a reasonable price to help in the work.

The onions were examined on June 19th, when it was found that the thrips were just beginning to make their appearance. The first application was made to a portion of the field on June 24th and 25th. The owner had obtained on trial a sprayer of the "wheel barrow" type designed to spray four rows, the pump being operated from the wheel, by means of a sprocket and chain gear as the operator pushed the outfit between the rows. It was found at the start that there was not sufficient power to carry four nozzles, so two of these were disconnected. Even with only two nozzles the onions were not thoroughly covered. The gearing was then detached from the pump lever and the row attachment discarded. Two lines of hose with short extension rods were attached to the pump and the work continued with one man to pump and wheel the outfit, and two to direct the spray as shown on plate VIII, b. The onions were sprayed as thoroughly as possible, but upon making an examination a few hours later it was found that the spray had not penetrated to the base of the leaves below the sheath which enclosed them. Most of the thrips at this time were below the sheath and as the spray had not reached them were as lively as ever. A few days later the owner reported that he could see no difference in regard to the number of thrips on the sprayed and the unsprayed onions. The following preparations were used in the tests:

"Black Leaf 40," 1 part to 768 parts of water and soft-soap.

"Black Leaf 40," 1 part to 950 parts of water and soft-soap.

"Scalecide," 1 part to 50 parts of water.

Lime and Sulphur, $1\frac{1}{2}$ parts to 50 parts water with paste spreader.

Homemade soft-soap was used as a spreader with "Black Leaf 40," the actual amount being determined by trial, which proved to be about one pint to ten gallons.

The "Scalecide" did not coat the onions as well as the "Black Leaf 40," and injury to the plants was apparent within a short time after being applied.

The lime and sulphur with flour paste as a spreader did not coat the onions satisfactorily.

On July 12th a portion of the field was sprayed with "Black Leaf 40," 1-950, with soft-soap as a spreader. This being applied with a barrel pump operated by a gasoline engine which held the pressure at about eighty pounds. At this time the

onions were much larger and the sheaths more open, and the spray appeared to reach nearly all of the thrips. The owner, however, reported later that he could see no benefit from this treatment.

THE PEA APHIS, *Nectarophora pisi* Kalt.

On June 13th, a market gardener in Hamden reported to this office that his peas and those of several neighboring growers were seriously infested with the pea aphis, and requested advice in regard to treatment. The pea aphis had not been especially troublesome in Connecticut since 1900, and consequently we had not tried any of the more recent preparations against this pest. We therefore offered to make, at once, a few tests to demonstrate whether or not this insect could readily be killed by spraying. The owner could then determine if it was practicable for him to treat his whole field.

The tests were made during the afternoon of June 13th, the same day that the report was received. About fifty feet on each of eighteen rows in the most seriously infested portion of the field were sprayed as follows:

- 3 rows, "Black Leaf 40," 2 teaspoonfuls in 1 gallon of water with paste spreader (4 lbs. flour to 100 gallons of water).
- 3 rows, "Black Leaf 40," 2 teaspoonfuls in 1 gallon of water with soap (4 lbs. in 100 gallons of water).
- 8 rows, "Black Leaf 40," 1 teaspoonful in 1 gallon of water with soap (4 to 100).
- 4 rows, "Scalecide," 1 part to 50 parts of water.

Spray mixtures do not stick readily to the smooth leaf-surface of peas, but gather in drops and roll off. A small amount of common soap dissolved and added to the mixture will usually cause it to spread readily and stick to the foliage. In addition to soap, flour paste was tried as a spreader in the above tests.

The flour paste has been used as a spreader in experiments conducted by the Bureau of Entomology, especially with certain contact insecticides where the addition of soap produced a chemical change. It is prepared by taking four pounds of cheap flour and adding cold water to make a thin, smooth batter. This is diluted with water to make four gallons and heated until it boils, and added to 100 gallons of spray mixture.

In our tests the flour paste did not prove as good a spreader as the soap.

The field was examined two days after the treatments were made, and the results were as follows:

"Black Leaf 40," two teaspoonfuls in one gallon of water with paste spreader.—All aphids hit by the spray were killed. Many live aphids were found on portions of the plants not coated with the spray. The material did not spread as well as where soap was used in place of the paste. More material was also used in attempting to thoroughly cover the foliage. No injury was observed from the spray.

"Black Leaf 40," two teaspoonfuls in one gallon of water with soap at the rate of 4 pounds to 100 gallons.—Very few live aphids could be found. The material spread well on the foliage. The spray, did not injure the foliage.

"Black Leaf 40," one teaspoonful in one gallon of water, soap at the rate of four pounds to 100 gallons.—This treatment was just as efficient as where twice the amount of "Black Leaf 40" was used.

"Scalecide," one part to fifty parts of water.—This spray did not spread as well as the "Black Leaf 40" with soap, and caused considerable injury to the foliage.

There were two varieties of peas in the field, Thomas Laxton and Sutton's Excelsior. No aphids were observed on the former, while the latter was generally infested and scattered areas were quite badly infested.

The vines were more or less lodged and nearly covered the ground. Most of the pods had been formed and the largest of them would be ready to pick within a week.

If the aphids had been observed at the time they first appeared, when the vines were smaller, the spray could have been applied more thoroughly with much less material. The injury to the vines in driving through the field would have been much less.

The owner at this time was very busy picking strawberries besides looking after other work which would have been somewhat neglected if he had stopped to spray the peas. The owner was afraid that many of the pods which were nearly ready to pick and which would develop in spite of the aphids, would be injured. Peas were selling at that time for about eleven dollars a barrel and the owner did not care to risk losing any of the earliest peas in order to save those to be harvested later when the price might be much less.

While the tests with "Black Leaf 40" were quite satisfactory, the owner, under the circumstances, decided not to spray the remainder of the infested field, though we are certain that it would have paid him well to do so. At the market price, a slight increase in yield, which was reasonably certain if the aphids were killed, would more than offset the cost of the treatment.

THE DYING HICKORY TREES.

In southwestern Connecticut and in adjoining portions of New York State during the past two or three years many hickory trees have died and many more have been injured. Though this condition is the result of a number of contributing causes, the chief one seems to be a small beetle known as the hickory bark beetle or bark borer, *Scolytus quadrispinosus* Say.

This beetle is black and about one-fourth of an inch long. The end of the abdomen is truncated strongly beneath and in the male bears four tubercles or spines, thus suggesting the specific name. The hairs upon the head form a veritable brush, which it has been suggested may be useful in cleaning out the galleries. During July and August the beetles tunnel in the new growth at the axils of the compound leaves, causing them to break off. Many drop to the ground, giving the tree a scorched appearance. Later, in the main trunk, the parent beetles make short, straight tunnels longitudinally just under the bark, and the female lays eggs in shallow pockets along the sides of this tunnel which is called the brood gallery or nuptial chamber. On hatching from these eggs the minute larvæ or grubs each make separate tunnels extending at right angles from the brood chamber, and therefore cut across the grain partly in the wood and partly in the inner bark or cambium. By the time the grubs are mature the side tunnels are often longer than the brood gallery, and they increase in breadth as they extend from it and as the grubs become larger; but they never intersect. Each grub keeps its own separate gallery. This necessitates that the end galleries be deflected away from the central ones so that they are not strictly at right angles with the brood chamber. The grubs pupate in the burrows and the adults emerge through small round holes in the bark, a badly infected tree appearing as though it had been punctured with bird shot.

Where there are many brood galleries in the main trunk of a tree the effect is the same as girdling, and the tree soon dies. In this manner thousands of trees have been killed in the vicinity of New York City, and in Connecticut, particularly in Fairfield County. The trouble is not a new one as it has been frequently recorded as occurring periodically in some portion of the country at least since 1872. For instance in 1901, 110 hickory trees died on the Hillhouse place in New Haven. The pest then subsided leaving a few trees which remain to this day, uninjured. On the Station grounds three trees died in 1912, and though we suspected the hickory bark borer to be the cause of their death, on cutting the trees, few of these bark borers could be found in them. Some other borers were present and sections of the wood were placed in breeding cages. Later we obtained a large number of specimens of a weevil or snout beetle, *Magdalis olya* Hbst. Dr. Hopkins writes that these are rarely found in the same trees with the hickory bark borer.

It is apparent, therefore, that while most of the trees are killed by the hickory bark borer, some trees die from other causes, probably drought being an important factor. Usually those trees standing on dry knolls or ledges are the first to go.

Badly infested trees cannot recover and should be removed. Dr. Hopkins recommends that all infested trees be disposed of between October 1st and May 1st, so as to kill the over-wintering beetles. This can be done by peeling, or by using the wood as fuel. If the outer portion is allowed to remain upon the logs during the following summer, the beetles will escape and may attack other trees. All dead trees should therefore be cut at the end of the season, and dead branches and tops of living trees should be removed and destroyed.

If a tree is not infested, but in danger from surrounding conditions, it may be worth while to spray the bark of choice trees on trunk and branches in early spring with lead arsenate, one pound in five gallons of water. After the growth has been formed for the season, say about July 1st, thoroughly spraying the foliage with the same mixture may prevent damage to the leaf stems. There are a number of secret preparations on the market claimed to penetrate the burrows and to kill the beetles without injuring the trees. Most of these preparations have not been tested except by their manufacturers, and it is now too

early to pass judgment upon them. As a rule these materials of great penetrative power are dangerous on account of injuring the trees, and it is usually wise to "beware of all secret preparations."

THE PEAR MIDGE.

Contarinia (Diplosis) pyrivora Riley.

Infested fruit from Cannon Station, Mystic and Watertown, received about June 1st, contained the larvæ of this insect. In each case the young pears dropped freely and a remedy was requested. This insect is of peculiar interest to the fruit growers of Connecticut, because it was first described from material gathered in 1884, in the orchard of Coe Bros., Meriden, Conn., by the late Dr. John B. Smith, who as an assistant to Dr. C. V. Riley, then Government Entomologist at Washington, had been sent to investigate the trouble reported by Mr. Coe in correspondence with Dr. Riley. Dr. Smith found that the insect belonged to the order diptera (two-winged flies) and to the family Cecidomyidæ (gall midges).

Larva, pupa and adult were described by Dr. Riley in the report of the Commissioner of Agriculture for 1885, page 287, though at that time it was thought it might prove to be the European species *D. nigra* Meig., the type of which was not available, if in existence. At that time the pear midge was supposed to be an introduced insect, was not known to occur elsewhere in America, and seemed to be confined to a very small region in the vicinity of Mr. Coe's orchard. Both Dr. Smith and Dr. Riley urged that the American Pomological Society, or some other organization, make an effort to stamp it out. This urgent advice apparently was not followed, though Mr. Coe had attempted to destroy his entire crop of pears in 1883, hoping in this way to get rid of the pest. In a few years the insect appeared elsewhere. In 1891 it was discovered at Catskill, N. Y., and in three localities in New Jersey, and is now known to be distributed in the Northeastern United States and in Central Europe. Several accounts of this insect have appeared in various reports of state entomologists and in entomological journals and bulletins.

The adult is a small two-winged fly which lays its eggs in the clusters at blossoming time, or even earlier. Dr. Felt has found

the larvæ at the base of the calyx at the time the petals fall,* and they soon work their way into the young fruit. The infested pears can nearly always be detected on account of their more globular, and later lop-sided shape, while the normal-shaped fruits are free from maggots. The infested pears usually crack open after a rain and thus allow the maggots to escape before the pears drop. When fully grown the maggots are about 3 mm. (one-eighth of an inch) in length. They go into the ground and form minute oval cells in which they pupate, and from which the adults emerge the following spring. There is one brood each year.

This insect has done considerable damage locally, especially in the New England states, New York and New Jersey. Certain varieties seem to be injured more than others, particularly Bosc, Bartlett and Seckel, in the order named. Dr. Smith states† that the insect has been gradually worked out in New Jersey and maintains itself in only a few places near Newark and New Brunswick.

No remedial treatment is known other than gathering and destroying the infested pears before the maggots leave them. This is comparatively simple because the infested pears are so easily distinguished from the healthy fruit. Cultivating the soil during the month of June would doubtless destroy many of the larvæ in the cells. Young pears infested by the maggots are shown on plate VII, d and e.

THE WEST INDIAN PEACH SCALE IN CONNECTICUT.

Aulacaspis pentagona Targ.

This insect was discovered this fall in Greenwich, Conn., on Chinese privet, *Ligustrum ibota*, by Mr. Walden. It had not previously been recorded from Connecticut, though fifteen years ago Cooley reported the species from Jamaica Plain, Mass.,‡ where it had been collected on different species of *Prunus*, growing on the grounds of the Arnold Arboretum. Though it is called the West Indian Peach Scale this species does not confine its attacks to peach trees but infests a great variety of plants belong-

* Report N. Y. State Entomologist, 28, p. 97, 1912.

† Insects of New Jersey, p. 729, 1909.

‡ Canadian Entomologist, XXX, p. 232, 1898.

ing to widely different botanical families. A full list of food plants was given by Webster* in 1898 and a partial list will be found in Mrs. Fernald's Catalogue of the Coccidæ of the World, page 235. The insect is now known to occur in China, Japan, Ceylon, Hawaiian Islands, New Zealand, Australia, Brazil, Panama, West Indies, South Africa, Italy, Switzerland and England. In the United States it has been reported from California, Florida, Georgia, Washington, D. C., Ohio, Massachusetts and now from Connecticut.

Dr. H. T. Fernald states† that this scale has been found abundantly on flowering cherry imported into Massachusetts. I now believe that it was present on weeping cherry imported from Japan three years ago into one of our Connecticut nurseries. We did not attempt to identify it at the time, but ordered the trees fumigated with hydrocyanic acid gas, to kill the scales which were present in moderate numbers on the twigs. These trees were planted out and were clean when afterward examined.

It is probable that the West Indian Peach Scale will not prove a destructive pest in this State. According to the published statements of Newell and Rosenfeld‡ it has been injurious in a few instances in Louisiana, but has not seemed to spread to new localities. Moreover, from the records of the effect of low temperatures on this insect§ it is doubtful if it will survive our severest winters. The winter of 1912-1913, was a comparatively mild one, and evidently the scale did survive it and spread over the plants in a small block of privet. Greenwich is on Long Island Sound and minimum temperatures are there much higher than in most inland towns.

This scale is circular, and larger and more strongly convex than most other armored scales found in Connecticut. It is closely related to the rose scale, *Aulacaspis rosæ* Bouche, but may be distinguished from it by the larger number of circumgenital pores in the female, when examined under a compound microscope. The rose scale is commonly found on roses and blackberry plants, and the exuviae are light yellow. In *A. pentagona*

* Canadian Entomologist, XXX, p. 79, 1898.

† Journal of Economic Entomology, Vol. III, p. 275, 1910.

‡ Ibid, Vol. I, p. 153, 1908; Vol. III, p. 215, 1910.

§ Ibid, Vol. I, p. 258, 1908.

the exuviae are orange-yellow and many of the scales are more or less covered by the epidermal tissues of the plant and therefore of the same color, making it much less conspicuous. When not covered by the bark of the host plant the scales are white and conspicuous like the rose scale. Where the scales have died and fallen from the twigs, the ventral scales remaining are also white and conspicuous. An infested privet twig is shown on plate VIII, a.

If the West Indian Peach Scale withstands our winters and infests and injures trees and shrubs, it is probable that a thorough spraying with a modern contact insecticide like the lime-sulphur wash or one of the oil mixtures, will serve to hold it in check.

MOSQUITO CONTROL WORK IN CONNECTICUT IN 1913.

In the report of this Station for 1912, page 283, it was stated that legislation would be sought providing for the control of mosquito breeding places and three bills were introduced.

One bill carrying an appropriation and providing for the drainage of large marsh areas under state supervision was finally passed by the house and senate, with the appropriation reduced to \$10,000.00 for the biennial period. This measure was vetoed by Governor Baldwin after the adjournment of the session in June.

The amendment to Section 2526 of the General Statutes was defeated.

The following important measure was enacted, and is now a part of the statute law of the State.

AN ACT CONCERNING PUBLIC HEALTH AND THE CONTROL OF MOSQUITO BREEDING PLACES.

Chapter 143 of Public Acts of 1913.

SECTION 1. *Public nuisance.* Any accumulation of water in which mosquitoes are breeding is hereby declared to be a public nuisance.

SEC. 2. *Authority to abolish.* When it has been brought to the attention of a health officer or board of health, through the complaint of any citizen, or when discovered by any inspector or agent of said health officer or board of health, that rain water barrels, tin cans, bottles or other receptacles, or pools near human habitations are breeding mosquitoes, it

shall be the duty of said health officer or board of health to investigate and to cause such breeding places to be abolished, screened, or treated in such manner as to prevent the breeding of mosquitoes. The health officer, or any inspector or agent employed by him, shall have the right to enter any premises in performance of his duties under this act.

Approved May 29, 1913.

EXAMINATIONS OF SUSPECTED BREEDING AREAS MADE ON REQUEST OF HEALTH OFFICERS.

At the request of Dr. Edgar Adams Wilson, Town Health Officer of Meriden, on June 23, I inspected a swampy area near the Undercliff Tuberculosis Sanatorium in Meriden. Dr. Williams of the sanatorium accompanied me and I tested the water in many places, especially around the margins of the woodland area where many red maple trees and various shrubs of a semi-aquatic nature, grow in the water. The water did not appear to be more than a foot deep, and was discolored by the dead leaves.

Mosquitoes fairly swarmed over this area. A number of adults, collected from my coat, and those reared from wigglers dipped from the stagnant pools, proved to be *Culex cantans* Meig., a species which flies only a short distance, though far enough to annoy the patients at the sanatorium, where, according to Dr. Williams, mosquitoes had been quite troublesome.

Though the water was tested at many points, only a few wigglers were found, but I am reasonably certain that this area, of perhaps an acre in extent, is a breeding place. Probably earlier in the season and at various other times during the summer, one would find larvæ much more abundant. There were certain mosquito enemies in some portions of the pool, but in bunches of grass and in the shallow water wigglers were present. I was informed that this pool is on land owned by the City of Meriden, and that it does not belong to the sanatorium.

Draining is a simple remedy and was promptly advised. A ditch was once cut, running in a northeasterly direction through the adjoining pasture, but had become partly filled. If this ditch could be deepened to about two feet, it would probably drain the entire area. It would not need a long ditch, as the pasture slopes away rapidly, and a depression further down the slope could be made to hold water if needed as a drinking place for the cows pastured there.

A report to this effect was sent to Dr. Wilson, and duplicate copies furnished the sanatorium and Mr. C. E. Hoadley, County Health Officer of New Haven County.

Later I was assured that an attempt would be made to carry out these recommendations.

On August 19, at the suggestion of Dr. E. C. M. Hall, Health Officer of East Haven, an examination was made of a certain area along the shore, between Momauguin and Silver Sands, just east of the area drained by the Anti-Mosquito Committee in 1912. Mr. Ripley made the examination and found that a portion of the area contained pools filled with wrigglers. A brief report containing the facts was at once sent to Dr. Hall.

EXAMINATION OF OTHER AREAS.

In coöperation with the Anti-Mosquito Committee and the City Park Department, we examined the ditches cut in 1912 in the salt marshes about New Haven, to see if they were in good condition to do active work, and also the pools in the public parks which in 1913 as in 1912, were kept oiled by the Park Department. Some of these areas were inspected several times, once in June and two or three times in July and August, and reports made to the proper authorities. In the parks the particular sections given most attention were Beaver Pond Park, Edgewood Park, and the meadows at the foot of East Rock. At Beaver Pond Park we found larvæ of the malarial mosquito late in the summer, and it will be very difficult to entirely prevent breeding here until some comprehensive system of improving this area is carried out. Oiling alone, though a benefit, will not do it.

At the base of East Rock there was little breeding except around the dump, near the corner of Willow and Mechanic Streets, where larvæ of the salt marsh mosquito and other species of *Culex* were very abundant.

The pools in Edgewood Park were kept oiled and were not found to breed mosquitoes except at a few places. This does not, however, apply to the main stream of West River, the conditions of which are described in the following chapter.

WEST RIVER RESPONSIBLE FOR A SCOURGE OF *Culex pipiens*
IN NEW HAVEN.

On August 5, Mr. L. B. Ripley, who had been sent to examine the pools in Edgewood Park, reported that he found wrigglers in the margins of the main stream (West River) especially in the coves, or where choked by vegetation or rubbish the water remained quiet. Small pools under the Whalley Avenue Bridge, existing on account of low water were literally alive with *Culex* larvæ.

On August 11, Mr. Ripley examined the stream above the bridge and found wrigglers very abundant, particularly between Blake Street and Valley Street bridges, through West Rock Park. With one dip of the ladle, which holds about a gill, 200 wrigglers were taken. From a further investigation we found that the west branch of the river, as far as the Pond Lily Company's dye works, was filled with wrigglers. Little or no breeding could be detected in the other branches of West River, where the water was clear.

The west branch receives the waste from the dye works and further down the stream the refuse from the Joseph Parker and Sons paper mills and the factories of the Geometric Tool Co., and of the Greist Mfg. Co. The dye stuffs in the stream discolour the water, often making it look like ink. It was a season of extreme drought and the water was unusually low, and therefore was nearly stagnant, and completely so in many pools which would be connected with the stream in high water, but in low water entirely separate. The dye stuffs had apparently either killed or driven away the fish, and mosquitoes were breeding here intensively—literally by millions. The wrigglers clustered around stones, sticks, dead leaves or any other objects in the water and they were visible from the banks at a distance of perhaps fifteen feet. Up to this time West River had not even been suspected of breeding mosquitoes.

This discovery explained a great mystery. Annually, for at least three years, in the entire western portion of the City of New Haven there has been a scourge of rain-barrel mosquitoes, *Culex pipiens* Linn., beginning the latter part of July and ending only on the approach of cold weather. The mosquitoes were very abundant in 1912 and fairly swarmed into cellars to hibernate, but they were probably worse in 1913, or would have been,

if control measures had not been adopted. In fact the writer has never seen them so abundant anywhere as they were in the western part of New Haven about August 1, 1913.

In 1912 when the Anti-Mosquito Committee of the Civic Federation caused all known breeding places in and about New Haven to be drained or oiled for the season, salt marsh mosquitoes were scarce, yet rain-barrel mosquitoes were abundant and many citizens who had contributed toward the mosquito campaign fund complained. They had given good money but there were still just as many mosquitoes.

Much searching was therefore done for rain-water barrels, though a thousand of them could not produce as many mosquitoes as this stream furnished. They fairly swarmed in protected corners of buildings, under verandas, and in shrubbery. They were innocuous during the day but as soon as it was dark they began to sing and to bite. Many were small and readily entered houses through the meshes of the screens. Unless the windows were kept entirely closed, or mosquito bars placed over the beds it was impossible to sleep at night.

Now the origin of the mosquito outbreak was no longer a mystery. What to do was the next question. The condition of West River was reported by telephone to the offices of the Board of Health and the Superintendent of Parks on August 12, and a formal letter was sent to each on August 14. On August 21, a meeting of the Board of Health was held and the matter considered. The writer, in company with a committee of the Edgewood Civic Association, consisting of Messrs. Chas. E. Brown, Geo. W. Crane and Carleton H. Stevens, attended this meeting, explained the situation and urged prompt action.

Considerable time must necessarily elapse before the Board could notify all property owners to abate this nuisance. The Board, under the new law becoming effective August 1, given on page 242, clearly had the right to abate the nuisance, but of course must go about it in a legal manner. Immediate relief was demanded. As a remedy, flushing the stream by opening the gates above was the simplest; but there was a serious drought and water was very low and could not be wasted. Hence the oiling method was chosen.

The Executive Board of the Anti-Mosquito Committee, therefore, voted to appropriate a sum of money, not to exceed \$50.00,

toward the cost, the remainder to be collected from interested persons. The writer was asked to take charge of the oiling work, which was started the next day, August 22. He was fortunate in being able to obtain the services of Mr. James E. Hitchcock, who was employed by the Anti-Mosquito Committee on the work in 1912. During the next few days the entire surface of the river, where mosquito wrigglers could be found, was sprayed with oil from a point opposite Ramsdell Street, near the Pond Lily dye works, eastward to the Whalley Avenue bridge, a distance of nearly one and one-half miles of the winding course of the stream. Also the canal near the paper mills and many detached pools that in high water are connected with the river, were treated. The winding course of the stream, with its brush-grown banks and its rough and irregular bed, partially filled with vegetation and rubbish, made the oiling work difficult and expensive.

Kerosene was used because it could be purchased immediately. Six barrels of crude oil, donated by the Geometric Tool Co., was also applied and gave excellent results. The oil was spread by means of two "double forester" pumps, one the property of the Civic Federation and the other kindly loaned for the purpose by the State Forester. See plate X.

The Park Department oiled the edges of the stream through Edgewood and West Rock Parks, but in the latter not enough oil was used and the work had to be done over by Mr. Hitchcock, the Park Department furnishing two men to help.

The entire cost of this work amounted to \$125.31, and was nearly covered by local contributions of money, labor and oil.

The treatment was effective. We examined the stream and could find few live wrigglers but thousands of dead ones floated down. A day or two after the work was finished rain carried off most of the oil and later one small brood of mosquitoes developed and the adults emerged, but were not a great nuisance because of the cooler weather and many of the larvæ were washed down stream by heavy rains in September and October. The myriads of adults which had emerged before oiling gradually disappeared and on the approach of winter, hibernating adult rain-barrel mosquitoes were much less abundant than in 1912. Apparently these mosquitoes were a nuisance nearly a mile distant from West River.

Unless some remedial action is taken, the condition may and probably will exist in West River each season of scant rainfall, as long as the pollution is allowed to continue. Once the pollution stops the stream can again be stocked with fish, and there will be no more mosquitoes from it. The bed should be cleared of rubbish, and straightened. I understand that the City Board of Health has already warned the property owners abutting the stream that the nuisance must be abated.

Adults, larvæ and pupæ were sent to Dr. L. O. Howard at Washington, who kindly confirmed our identification; it was the rain-barrel mosquito, *Culex pipiens* Linn.

OTHER SIMILAR OUTBREAKS.

Howard, Dyar and Knab record a similar outbreak near Urbana, Ill., where a creek is practically stagnant in late summer. At a certain point this creek receives the waste from a slaughter house, and for some distance below was so charged with decomposing animal matter that no fish could live in it, though it contained millions of wrigglers of rain-barrel mosquitoes. Adults covered the trees and bushes along the banks, but their presence was felt only for a short distance, and few of them reached the town perhaps a mile away. They continued to reproduce until cold weather.*

Another interesting outbreak of rain-barrel mosquitoes which occurred in 1913 in Greenwich, Conn., was described to me in a letter by Mr. Edwin M. Skinner, President of the United States Drainage and Irrigation Co., of New York City. Just north of the village of Mianus, there is a dam six or eight feet above tide level, formerly used to furnish power for the Palmer Bros., gas engine plant, but now abandoned for another site where steam is used. About 500 yards north of the Palmer dam, is another dam about six feet high, where a grist mill used to stand but of which only the sluiceway and part of the water wheel remain. These dams are not used but on account of sewage emptying into the river above and between them, they are allowed to remain rather than permit the sewage to be exposed.

* The mosquitoes of North and Central America and the West Indies, Vol. I, p. 135, 1912.

A short distance above the second dam there is a mill where lap-robcs and cheap plush goods are made from cow-hair and low grade wool. A cheap grade of oil is used in spinning the raw wool and cow-hair, and the product is washed with water from the river which again flows into the stream. Probably dye stuffs are also used and emptied into the river. These waste materials, together with the sewage held back by the dams, probably destroyed the fish and furnished an ideal breeding place for rain-barrel mosquitoes. The stream flow was slight in the period of drought, and the water was stagnant and slimy and thickly filled with wrigglers. The river is about 100 feet wide by the grist mill dam and perhaps 150 feet broad at the Palmer dam and literally filled with larvæ.

Above the woolen mill is another dam, above which the water is pure and sweet. The health officer ordered the gates lifted at this upper dam and all the wrigglers were washed into Long Island Sound the same day that they were discovered.

CUTTING AND MAINTAINING DITCHES IN 1913.

In New Haven the Anti-Mosquito Committee collected a small amount of money in 1913, and with it kept clear the ditches cut in the salt marshes in 1912. Similar maintenance work has also been done at Shippan Point, Darien, South Norwalk and Fairfield.

Considerable draining and filling has been done in the town of Greenwich, little of it, however, applying to the salt marsh. Many fresh water pools and swamps, which have in previous years been breeding places of malarial mosquitoes and various species of *Culex*, have been eliminated throughout an area extending along the coast and about two and one-half miles inland or as far as the village of Glenville. The north line of this area is parallel with the north town line.

ENTOMOLOGICAL FEATURES OF THE SEASON.

Following the mild weather, the spring of 1913 was cool and with abundant rainfall during May. In June, July and August the rainfall was much below the normal, resulting in a severe drought in which many native trees and plants were vitally injured, and cultivated crops reduced in yield. Heavy rains came in September.

The climatic conditions cannot fail to effect insect life, though less directly than plant life. Many hickory trees have died, chiefly from the attacks of the hickory-bark borer, particularly in the southwestern corner of the State. In some localities oaks have died, but these trees, like the hickories, have evidently been injured by freezing or drought or both, and were attacked afterward by various bark beetles.

White grubs have been comparatively scarce and except in one or two cases, have not been reported as damaging crops.

The Colorado potato beetle, too, was not abundant and nearly all larvæ that we observed carried Tachinid parasite eggs.

The apple-tree tent-caterpillar was more abundant than we have ever seen it and roadsides and neglected apple trees and bushes were stripped. The damage was apparently greater inland than along the coast. Cocoons gathered at Stonington were strongly parasitized.

The forest tent-caterpillar was also more common than usual, though not very destructive.

Cutworms were not particularly abundant.

Aphids caused much damage, especially the rosy and green apple aphids, and the cabbage and pea aphids.

One of the chief features of the season is the discovery of new territory infested by the brown-tail moth. The scouting in the previous winter shows that insect to have spread much farther westward than was supposed.

The gypsy moth is now almost eradicated at both Stonington and Wallingford, the only two infestations found in the State.

The more important of these insects are treated in some detail in the separate articles and notes of this report.

MISCELLANEOUS INSECT NOTES.

The Dying Oak Trees.—On September 24, 1912, the writer was called to examine some oak trees which were dying on a large place owned by Mr. Mallory in the extreme southwest corner of Greenwich, just over the line from Port Chester, N. Y. The trees began dying in July, after having made their season's growth, and were mostly chestnut oaks; a few white oaks and a few of another kind, possibly black oaks, had also died. As

the trees all stood upon a ledgy knoll, the extreme drought seemed largely responsible for their death, though bark borers were at work in them. Another visit was made to this place August 5, 1913, in company with Dr. G. P. Clinton, botanist of this Station, Mr. H. W. Merkel of the New York Zoological Park, and Messrs. F. A. Bartlett of the Frost and Bartlett Co. of Stamford. More trees had died and one white oak had just been cut upon which the writer observed winter injury in 1912. In 1913 borers were at work under the bark where none were found the preceding year. Plate XII, b, shows the appearance of a piece of bark from a chestnut oak which had just been felled. The larger galleries were made by a common flat-headed borer, *Chrysobothris femorata* Fabr., and the smaller ones by the two-lined chestnut borer, *Agilus bilineatus* Web. Both kinds of larvæ were present in the burrows.

From other trees examined and reported, our opinion is confirmed that the trouble is due, not primarily to insects but to winter and drought injury, followed by these borers which are well known to attack weakened and unthrifty trees.

Flight of Spruce Bud Moth, *Tortrix fumiferana* Clem.—A brief note in the report of this Station for 1912, page 291, mentions this moth as being unusually common in 1912, but it was even more abundant in 1913. Swarms appeared the last day of July and newspapers in different parts of the State commented upon it the following morning. The following appeared in the *Hartford Courant* of August 1st: "The city was infested last night by a scourge of moths which appeared suddenly and in great numbers. In some parts of the city the insects were so numerous last night that they completely covered the windows and screen doors of lighted restaurants and stores. The moths are spotted with gray and a dirty shade of brown."

On the day that this item appeared a reporter on one of the New Haven daily papers telephoned to this office for information, and stated that he observed the moths to be very abundant around the lights at the corner of Chapel and York streets. Mr. Ripley was sent to obtain adults which we at once recognized as the spruce bud moth. Hundreds of them had been at this corner, many had been crushed on the sidewalk, and some were resting upon the poles and on the walls of the adjoining buildings. In a few days, however, all had disappeared.

The larva of this insect, in a spruce twig, was received from Mr. E. Kent Hubbard, Jr., of Middletown, who had collected it in the Maine woods. Several adults were received at this office August 2, collected around lights at New London by Dr. Chas. B. Graves, and August 4, by John H. Osgood at Putnam.

Parsley Stalk Weevil, *Listronotus latiusculus* Boh.—On August 16, Dr. Clinton brought in some parsley plants from the vegetable farm of A. N. Farnham of New Haven, which had been injured by this insect. The crown of each plant had been tunneled by the larva, as shown on plate XI, b, and the plants though alive were sickly and wilted. Mr. Lowry visited the place August 18, and obtained more material. On some of the plants the tunnels showed on the outside, and two and three larvæ are sometimes found in the same plant. The infested plants usually decay just below the surface of the ground, though the root below the point of attack may remain sound for a time. The infested plants at Mr. Farnham's were all growing in cold frames. It is doubtful if there is any practicable remedy, though carbon disulphide injected into the soil might kill the larvæ. An account of this insect may be found in Bulletin 82 of the Bureau of Entomology, page 14, U. S. Department of Agriculture. The insect has not previously been reported from Connecticut.

The Cottony Maple Scale, *Pulvinaria vitis* Linn.—This insect attacks many different trees and shrubs but is chiefly a pest of soft maple shade trees. In Connecticut it has seldom been injurious and usually a few specimens only are found on a tree. At Sound Beach, Stamford, the silver maples on several streets in a certain locality are now badly infested. The underside of nearly all branches are lined with scales and the trees more or less injured. Some of these trees were sprayed last spring with the miscible oils which seem to be effective. This insect is known in literature as *Pulvinaria innumerabilis* Rathvon, but studies by Professor J. G. Sanders* showed it to be identical with the European *P. vitis*, under which name it must now be known.

* Journal of Economic Entomology, Vol. II, p. 433, 1909.

Abundance of *Omphalocera dentosa* Grote.—This insect was described and illustrated in the report of this Station for 1911, page 292, as a pest of barberry hedges. It has apparently been more abundant and has done more damage in 1913 than in any preceding year since our observations began. Hedges of Japanese barberry (*Berberis Thunbergii* D. C.) and of the common barberry (*Berberis vulgaris* Linn.) were attacked. A tall hedge of common barberry was practically defoliated at the top and the larval webs were so numerous as to render it unsightly. In inspecting nurseries, the work of this insect was noticed at New Canaan, Stratford and New Haven. Purple-leaved barberry plants in a New Haven nursery were nearly stripped of their leaves but contained a mass of old webs. The writer also noticed barberry bushes growing by the roadside in North Guilford, which had lost nearly all of their leaves from the attacks of this insect.

The Eggs of *Hemerocampa definita* Pack., and Their Resemblance to Gypsy Moth Eggs.—Occasionally we find the egg-clusters of this tussock moth, which is apparently not very common, and they are often mistaken for those of the gypsy moth. Though there is great variation, certain egg-clusters are about the same size, shape and color as gypsy moth egg-clusters, but the hairs are somewhat coarser, more crinkled, the whole cluster more loosely constructed, and the eggs more exposed. As a rule, also, the eggs of *Hemerocampa* are deposited on a network of silk on or near the old cocoon, which is often on a leaf which is also fastened to the twig by silk threads. Gypsy moth eggs are usually laid on a solid surface, except in case of great abundance. In two apple orchards near Gales Ferry, Mr. Caffrey found some of these egg-clusters fastened directly to the bark and greatly resembling gypsy moth eggs. There is a difference in the micropylar structure of the eggs of these two moths, which will generally serve to fix their identity, but even entomologists have been mistaken regarding them. *Hemerocampa definita* is a near relative of the White Marked Tussock Moth, described in the report of this Station for 1905, page 230; it is, however, much less common and its eggs are shown on plate XII, a, of this report. Mr. Caffrey found *H. definita* fairly common in the northern part of the State, and we have

records of its occurrence in Thompson, Putnam, Union, Stafford, Willington, Mansfield, Somers, Enfield, Coventry, Ellington, Manchester, Tolland, Bolton, Eastford, Ashford and Ledyard. The eggs have been found in Connecticut on apple, cherry, poplar, willow, rose, plum, hawthorn, alder, lilac and birch.

Cocoons of the Promethea Moth, *Callosamia promethea* Drury.—Each year the cocoons of this moth are sent in by correspondents who think that it may be some important pest. During the past year specimens have been received from Elliotts, Collinsville, Guilford, Lebanon, New Canaan, West Haven and twice from Wallingford. The cocoons hang from the lower branches of sassafras, tulip, wild cherry and occasionally peach and plum trees. Each cocoon is usually rolled in a leaf with a strong silk fastening around the petiole, as is shown on plate IX, c, so that it is difficult to tear it from the tree. The adult moth is one of our larger species of night-flying moths. The female resembles the Cecropia moth, though smaller, and the male is nearly black.

Subsidence of the San José Scale.—This insect, which for fifteen years has been a serious enemy of fruit trees, seems to be now on the wane. Many old apple trees badly injured a few years ago, and which have not been sprayed, are taking on new vigor and seem to show only a slight scale infestation. We had supposed this to be result of lady beetles, two species of which commonly feed upon the San José Scale. Specimens of scale gathered this fall by Mr. Davis show many holes from which small hymenopterous parasites have emerged. We have not reared the adult parasite but it is probably a species already known, and may be the same that has been cleaning up the orchards in Pennsylvania.

Galls on Gooseberry.—While inspecting imported nursery stock in East Haven, April 23, Mr. Walden was asked to look at some unthrifty gooseberry plants in a neighboring yard owned by Mr. Eugene Wilson. Many of these plants were dead, and some of the living and dead plants had curious galls near their tips, much resembling the illustrations of galls on currants in England, caused by the currant mite, *Eriophyes ribis* Nal., and

known as "Big Bud."* We were unable to find any statement to the effect that this mite attacks the gooseberry in England, but it does injure black and red currants. No mites or other animal life could be found in these galls, which may be those of the gooseberry gall midge *Rhopalomyia grossulariæ* Felt. described and figured by Professor J. S. Houser of the Ohio Station.† The owner was advised to cut off and burn all twigs showing these galls. See plate XI, a.

Abundance of Spittle Insects.—Everyone is more or less familiar with the small masses of "spittle" or froth on the stems of grass, caused by small immature sucking insects of the family Cercopidæ, often called "spittle insects" or "frog hoppers." These insects were unusually abundant in 1913, and nearly every stalk of grass, in some fields, carried a mass of froth. One's clothes would become soaked in walking through the grass.

These insects are supposed to cause some injury, but the matter is not well understood, and not one life history of a single American species has ever been worked out.

Interesting Pupa Cells of the Clover Weevil, *Phytonomus punctatus* Fabr.—On May 17, Mrs. Robert F. Mitchell sent to the office some of the pupa cases of this insect which were very abundant in the soil of her garden in New Haven. These were placed in a breeding cage and in a few days the adults began to emerge. The clover weevil is rarely injurious in Connecticut, though the larvæ feed upon clover leaves. The pupa cells are small lace-like oval cases, about three-sixteenths of an inch in length, pale green in color, and are shown with larva and pupa on plate VII, c.

Birch Leaf Skeletonizer, *Bucculatrix canadensisella* Chamb.—The injury by this insect, which was so conspicuous in the State in 1910 and which has somewhat subsided, is still apparent. Though present over the entire State as in 1911 and 1912, the center of attack has moved westward, and seemed to be the most serious in the northwestern portion of the State where yellow and black birches were attacked. A full account of this insect is given in the report of this Station for 1910, page 701.

* Theobald, *Insect Pests of Fruit*, p. 240, 1909.

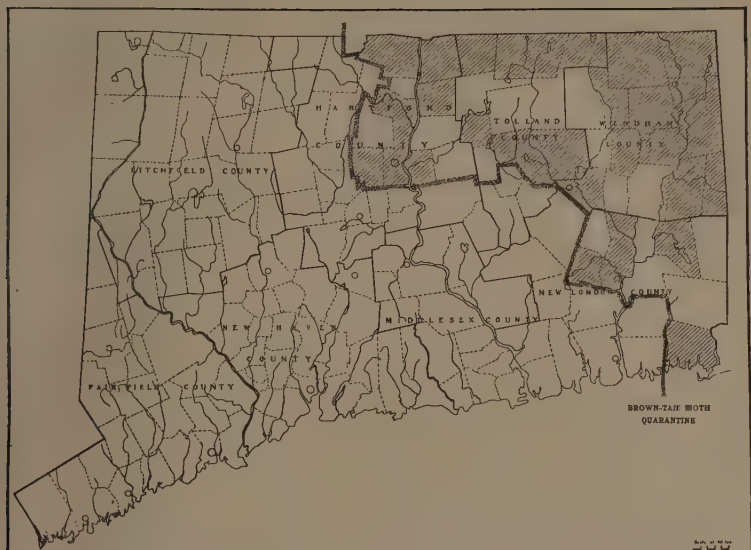
† Houser, *Journal of Economic Entomology*, Vol. V, p. 180, 1912.

Elm Leaf Beetle, *Galerucella luteola* Müll.—In some of the shore towns and cities, and especially where spraying has been practiced for several years, this pest was rather scarce during the past summer. On the other hand it was extremely abundant in certain inland towns, particularly in Litchfield County. The writer also observed many unsprayed elms in Woodbury which lost nearly all their leaves in July from the attacks of the larvæ, aggravated no doubt by the severe drought. Trees in the vicinity which had been sprayed remained in good condition.

The Poplar Sawfly, *Trichiocampus viminalis* Fallen. During the past three or four years the larvæ of this sawfly have been rather common on Carolina poplars near the Station, and late in August may be seen crawling down the trunks of the trees presumably to seek a place in which to pupate. The full-grown larva is four-fifths of an inch long, orange-yellow, marked with black spots, and bearing whitish hairs. There are two broods each year, the larvæ of the first brood appearing in June. These caterpillars feed upon the leaves and may be poisoned by spraying the tree with lead arsenate in case they should become destructively abundant. The adult is a small four-winged fly.

The Linden Borer, *Saperda vestita* Say. Larvæ of this beetle were rather common in young linden trees in one nursery this year. They tunnel under the bark and in the wood at the base. Decay often starts involving the entire stem, the leaves shrivel and the tree dies and breaks off. Trees in all stages of injury were found. Mr. Lowry captured an adult beetle in Wallingford, June 23. Where this borer causes damage, the only remedy is to examine the trees in May and September and to dig out the larvæ or kill them in the burrows with a wire, or by injecting a few drops of carbon disulphide and closing the opening.

Abundance of Tarnished Plant Bug, *Lygus pratensis* Linn. The tarnished plant bug was unusually abundant in 1913, and injured many different plants by sucking the sap from the bud or leaf stem causing that part to "blast" or wilt. Several complaints were received regarding injury to Dahlia buds, and in Litchfield potatoes were damaged by this insect. It is doubtful if a satisfactory remedy exists.

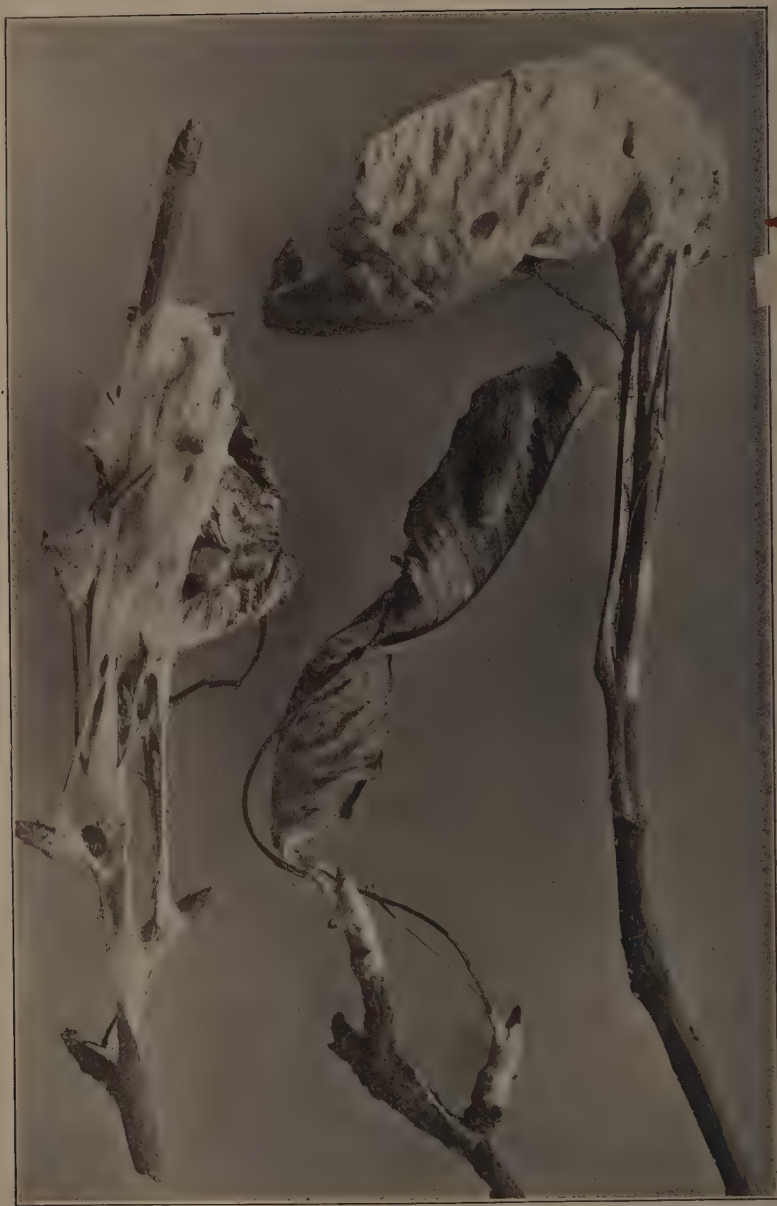


a. Map showing quarantine line and present distribution in Connecticut.



b. Winter nests on pear trees in Hartford.

THE BROWN-TAIL MOTH.

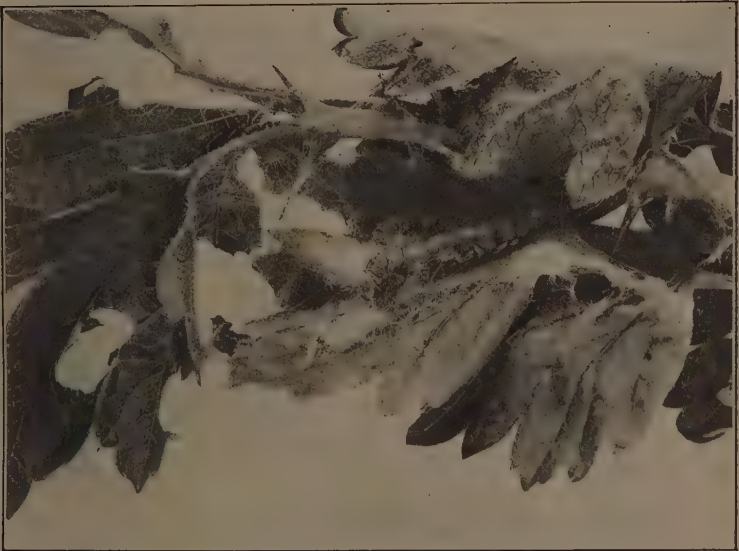


Winter nests cut from pear tree in Hartford; center nest shows old egg-mass on leaf; natural size.

THE BROWN-TAIL MOTH.



a. Leaves of California privet, drawn together.

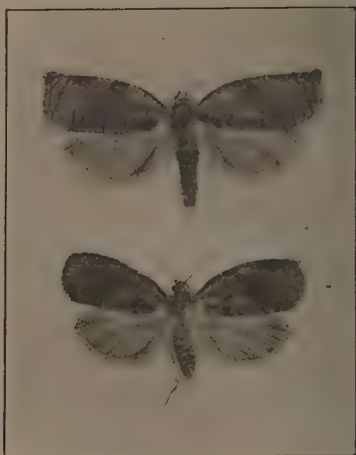


b. Larva on gooseberry.

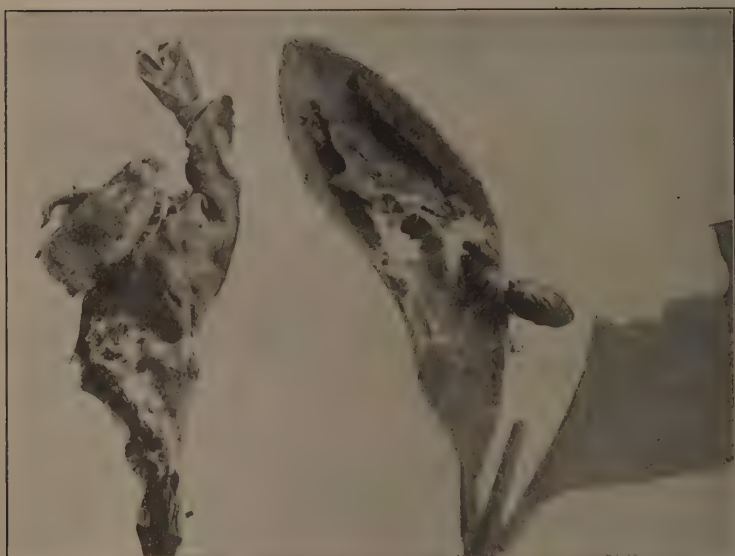
A LEAF-FOLDER *Archips rosana* Linn.



a. Larvæ and pupa.



b. Adults, female above.



c. Pupa case and adult.

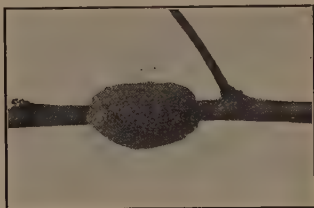
A LEAF-FOLDER *Archips rosana* Linn. All figures twice natural size.



a. Nest in apple-tree.



b. Adults, female above. Natural size.

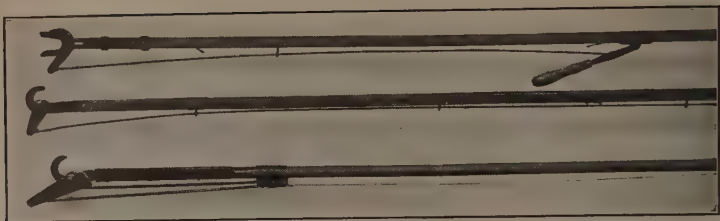


c. Egg-mass on twig. Natural size.

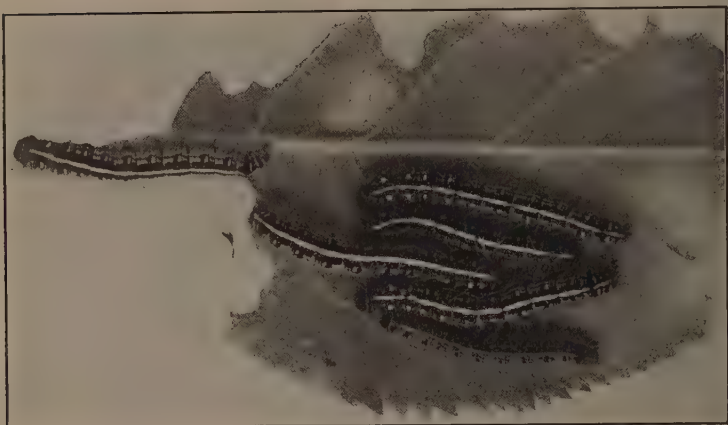


d. A consignment of imported stock in a Connecticut nursery.

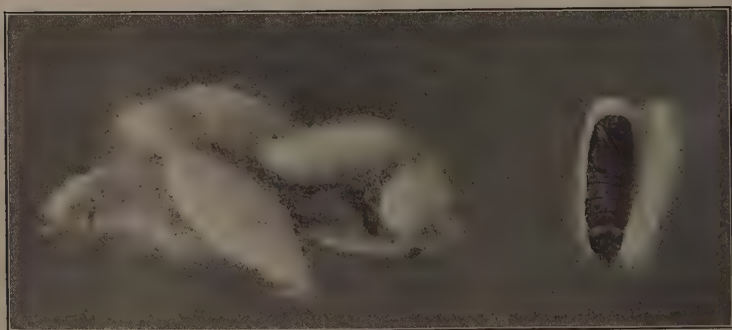
APPLE-TREE TENT-CATERPILLAR; IMPORTED NURSERY STOCK.



a. Tree pruners for clipping off egg-masses.



b. Caterpillars. Natural size.



c. Cocoons. Natural size.

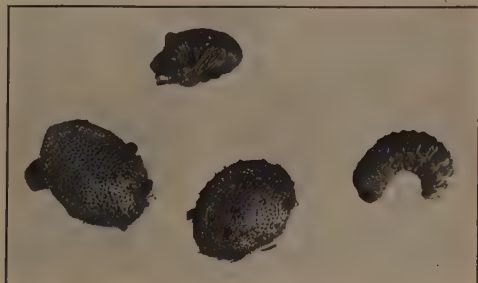
APPLE-TREE TENT-CATERPILLAR.



a. West Indian
peach scale.
Twice enlarged.



b. *Otiorhynchus sulcatus* Fabr. Larva,
pupa and adult. Twice enlarged.



c. Clover weevil, larva, pupa and pupa cases
Twice enlarged.



d. Pear midge. Young pear showing maggots inside. Three times
enlarged.



e. Pear midge. Infested pears, natural size.



a. View on Station grounds.



b. Spraying onions at Wethersfield.

CONTROL OF ONION THRIPS.





a. Immature thrips
much enlarged.



c. Cocoon of *Promethea*
moth. Natural size.



b. Onion plant injured by thrips.
Natural size.



a. Oiling canal near paper mill.



b. A disconnected pool filled with wrigglers.

MOSQUITO-BREEDING PLACES.





a. Galls on gooseberry.

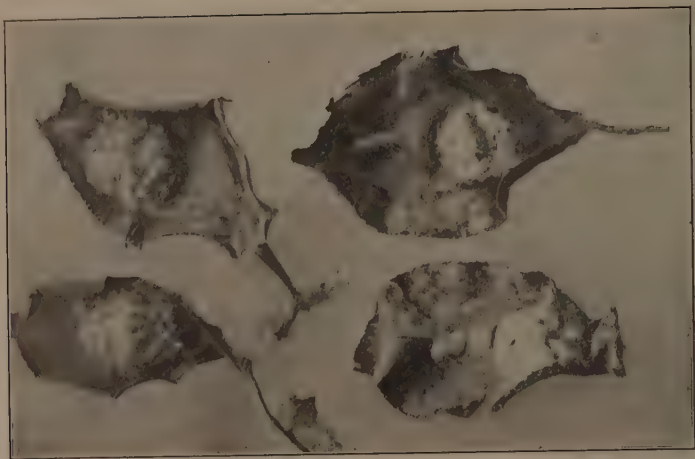


b. Parsley plants injured by weevil.

GOOSEBERRY GALLS AND PARSLEY STALK WEEVIL.

Both natural size.

PLATE XII.



a. Egg-clusters of *Hemerocampa defnita* Pack. Natural size.



b. Large galleries were made by *Chrysobothris femorata* Fabr. and small ones by *Agrilus bilineatus* Web. Natural size.

TUSsock Moth Egg-clusters; Work of Borers in Oak Bark.

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